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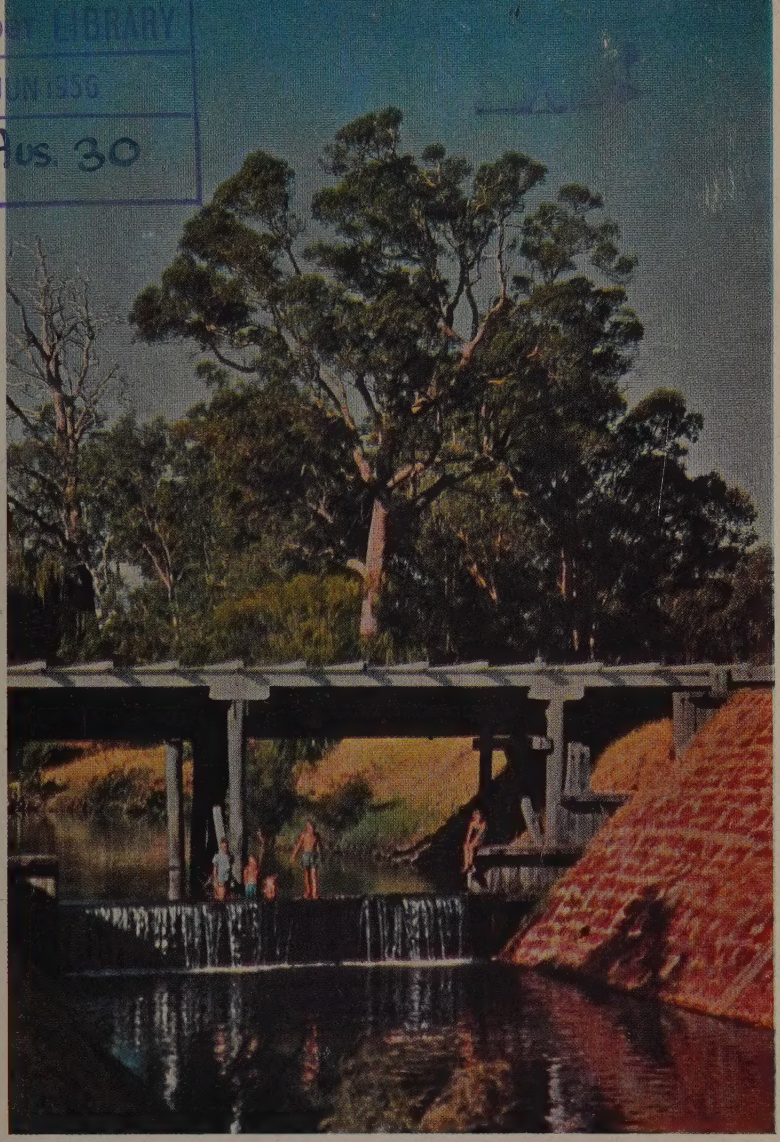

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Some Common Causes of Death in Young Pigs

By P. M. A. HARWOOD, Veterinary Surgeon.

AS distinct from the mortality caused by the recognised "killer" diseases, many deaths which occur in pig herds are due to factors such as faults in feeding and management, the importance of which are often not fully realised by pig owners. Quite frequently, closer attention to what may appear to be minor points will result in a greater percentage of the litters being reared to marketable weights—with a corresponding increase in the profit margin.

Deaths occur at all ages, but the majority of losses are in young pigs. Many occur even before the piglets have separate existences—through abortions or still-births. Losses prior to weaning are heavy and, at the weaner and slip stages, acute worm infestation may take heavy toll.

ABORTIONS AND STILL-BIRTHS

Several factors can be responsible for abortions and still-births and it is often difficult to reach a definite diagnosis. Disease, nutritional deficiencies, heredity, over-fatness and injuries can all play their parts, and this outline of some of the major causes of losses may point the way to a reduction in the mortality rate.

Leptospirosis.—A bacterial infection which is possibly the most important cause of death or weakness in piglets in this State. Two similar micro-organisms are found, one causing a severe mortality, the other seldom being fatal. No clinical evidence of infection is found excepting a slight rise in temperature.

Another important aspect of this condition is the fact that pigs can transmit the micro-organism to cattle, causing the disease "redwater." Pig urine draining into water supplies may lead to widespread infection of cattle.

Brucellosis.—A bacterial infection closely allied to that causing contagious abortion in cattle. The micro-organism responsible for brucellosis in pigs has not yet been found in Western Australia, but where sows are aborting for no obvious cause blood samples should be submitted for analysis.

Other Bacterial Infections.—Several other bacteria cause abortion in sows. Abortions are usually accompanied by signs of illness, and any condition causing fever in a pregnant sow may give rise to abortion.

Mineral Deficiencies.—In many wheat-belt districts, pigs are fed largely on wheat which does not supply sufficient calcium (lime) for the needs of the pregnant sows. Lack of lime is a common cause of abortions or still-births, and calcium-rich supplements such as ground limestone or bonemeal should be included in the ration.

Deficiencies of other minerals such as copper, iron, manganese, cobalt, etc., may affect the development of piglets during

Fig. 1.—Healthy litters are born and reared when the parents are carefully selected and when the sows are fed and managed correctly throughout the gestation period

pregnancy. Even where the deficiency is not severe enough to cause abortion or still-births, the sow's milk supply may be affected so that the piglets, although born alive, die from lack of nourishment.

Vitamin Deficiencies.—The most important vitamin is Vitamin A. This vitamin occurs in natural green feed and coloured root crops (carrots and swedes). Unless at least ½ lb. of good quality green feed can be fed daily, the sow's ration should be supplemented with shark liver oil. Dry grazing will not provide adequate quantities of Vitamin A.

Protein Deficiency.—This relates in particular to proteins of animal origin, such as are found in meatmeal, fishmeal, skim milk, whey, etc. Proteins of this type contain an essential factor for the promotion of growth that is not present in protein of vegetable origin. Severe protein deficiency results in abortion and still-births. Lesser deficiencies give weakly, poorly-developed pigs and lowered milk supply.

Injury.—Severe bruising or over-exertion may result in abortion or still-born pigs.

Lazy Sows.—Fat, inactive sows bearing large litters often have abnormally long periods of labour. Piglets are born dead due to suffocation during slow birth. Fatness is a most undesirable feature in breeding sows, and old sows are often bad mothers.

Hereditary Factors.—Where related boars and sows are mated, so-called "lethal factors," which are accentuated by close inbreeding, may result in still-birth in litters. The pigs may be obviously deformed and abnormal, or they may fail to develop. Except when breeding stud pigs, a totally unrelated boar is the best to use.

DEATHS IN VERY YOUNG PIGS

Crushing.—The most frequent cause of death in very young pigs is due to crushing or smothering by the sow. Although these losses may be minimised by the use of properly-constructed farrowing pens, farrowing rails and hover boards, it is felt that overfatness on the part of the sow is the chief contributory cause. Sows should never be allowed to become too fat and should be allowed ample exercise during pregnancy. It should be born in mind that old lazy sows are more likely to lay on their piglets than young active sows.

Deaths from this cause are usually limited to within two days of farrowing, and the dead pigs are obviously crushed by the weight of the sow.

Savaging.—Some sows will savage their litters and often eat the piglets. It has been suggested that a protein deficiency is responsible, and all pregnant sows should receive adequate protein supplements to their rations. Sows appear to acquire the habit of savaging their pigs, and such sows are not worth keeping.

Vitamin and Protein Deficiencies.—Deficiencies of Vitamin A, minerals or protein in the sow's ration often give rise to a condition whereby the pigs are apparently normal at birth, but due to lack of vitality, do not suckle and consequently "fade away" in the course of two or three days. The condition can be rectified by adding to the vitamin requirements with shark liver oil and seeing that the ration contains adequate quantities of green feed, minerals and meatmeal.

Piglet Anaemia.—This condition usually becomes apparent when pigs are kept in concrete-floored sties and are unable to obtain access to soil and green feed. The young pigs appear normal at birth but after two or three weeks they lose condition, develop a white scour and die within a few days. When the body cavity is opened it usually contains fluid, the liver is pale and enlarged and the organs are bloodless.

Anaemia may be caused by a deficiency of iron and copper in the diet. Grazing and access to soil by the sows will often prevent the disease. Young pigs should always have soil available in the sties as they can usually obtain adequate supplies of copper and iron from this source.

Milk Fever.—"Milk Fever" or hypocalcaemia is rather uncommon in sows. It is not a true fever as the temperature usually drops below normal. The sow becomes comatose or unconscious and often dies if the condition is not relieved. Injections of calcium boro-gluconate (1 to 2 oz.) under the skin usually bring about a rapid recovery.

A condition resembling milk fever, except that the sow has a high temperature is sometimes seen in sows. It responds to injections of streptomycin.

Both these ailments of sows cause failure of the milk supply and the young pigs die from lack of nutrition.

DEATHS IN WEANERS, SLIPS AND STORES

Acute Worm Infestation.—The common pig roundworm passes a complex cycle within the pig's body before it reaches the bowels. During part of the migration it penetrates the liver, causing damage to this organ. Where a massive infestation is picked up, the damage caused to the liver may cause sudden death. In such cases the liver is black and "rotten" in appearance, and the body cavity contains blood-stained fluid. There are few or no worms in the bowel.

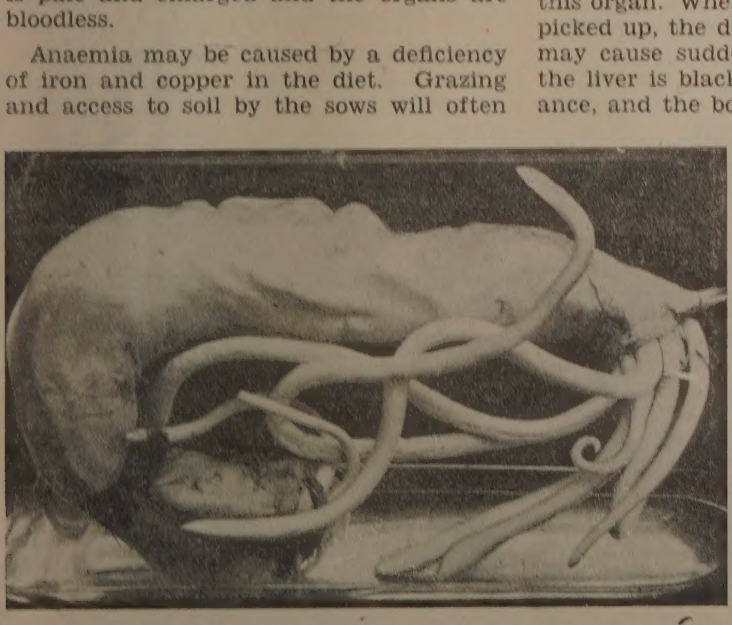

Fig. 2.—Portion of the small intestine of a pig that was heavily infested with large roundworm.

The second stage of migration takes place when the young worms enter the lungs. This stage is frequently recognised by pig-owners when young pigs exhibit the "thumps" or "pants." When large numbers of worms are involved, rapidly fatal pneumonia occurs.

Treatment with sodium fluoride is ineffective for either of these conditions, as the drug is only active in mature worms

in the bowel. Precautions should therefore be taken to ensure that young pigs do not run on worm infested land.

Acute Pneumonia.—Infectious pneumonia is often responsible for sudden death in pigs from weaner to store baconer ages. The symptoms are disinclination to move, staggering gait, and panting. Death soon follows. Treatment with sulphamezathine or penicillin injections is often effective.

Chronic Worm Infestation.—Heavy infestation of roundworms sometimes causes sudden death by obstructing the bile duct or even causing rupture of the bowel.

The pig dies very suddenly. Where the bile duct has been obstructed, the carcass is jaundiced and the liver is a coppery green. Where the bowel is ruptured, worms will be seen lying in the body cavity, which will contain evil-smelling fluid.

Roundworms in the bowel may be very satisfactorily treated with sodium fluoride.

Poisoning.—Poisoning may be caused by eating poisonous plants, or by eating chemical poisons that have been left where pigs have access to them. In swill-fed pigs, poisoning by common salt is sometimes seen.

Death is usually sudden, and may be preceded by intense scouring and vomiting.

Phosphorus is commonly a cause of death in pigs, as it is often accessible to them in the form of rat baits.

In cases of poisoning the stomach and bowels are intensely reddened, and may even contain free blood.

Pigs of all ages may be affected, but poisoning is most often seen in young pigs.

Heart Disease.—Pigs sometimes develop a heart disease after bacterial infections such as erysipelas. They appear to be quite normal and make good growth after recovering from the disease, only to drop dead after exertion. On opening the heart cavity, cauliflower-like growths may be seen on the surfaces of the heart valves.

CONCLUSION

Many cases of sudden death occur on pig farms without being properly explained. Rapid detection of the cause of death may prevent further losses. It has been attempted to describe here the causes of mortality other than those by diseases normally recognised by pig-breeders and adequately dealt with in other articles.

Where a bacterial agent is suspected, attempt to submit the whole carcass to the Animal Health and Nutrition Laboratory for examination before decomposition has commenced.

Where poisoning is suspected, submit the stomach and bowel contents, plus a piece of liver, kidney, thigh muscle and a bone for examination.

Where the help of the laboratory cannot be sought, always perform a post-mortem and attempt to determine the cause of death.

By no means all causes of death are due to infectious agents, but rapid diagnosis may help to prevent further losses.

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AGRICULTURAL CO-OPERATION IN GREAT BRITAIN, by M. Digby. Lond., 1949.

ECONOMICS OF AGRICULTURAL PRODUCTION AND RESOURCE USE, by E. O. Heady. N.Y., 1952.

FARMERS CO-OPERATION IN SWEDEN, by A. H. Gulander. Lond., 1948.

RURAL INDUSTRIES IN THE AUSTRALIAN ECONOMY, by I. Shannon. Melb., 1955.

THE SECRET OF THE GREEN THUMB, by H. T. Northen and R. T. Northen. Lond., 1954.

SOIL BLOCK GARDENING, by J. L. H. Chase and A. J. Pouncy. Lond., 1955.

FARM MANAGEMENT

FARM ORGANISATION AND MANAGEMENT, by G. W. Forster. 3rd ed. N.Y., 1953.

A SIMPLE SYSTEM OF ECONOMIC ANALYSIS OF A FARM BUSINESS, by C. H. Blagburn. Reading, 1954.

AGRICULTURAL MACHINERY

CROP DRYING, BARN AND STORAGE MACHINERY, by J. A. C. Gibb. Lond., 1955.

FARM ARC WELDING, by V. J. Morford. Cleveland (Ohio), 1954.

"FARM MECHANISATION" DIRECTORY, 1955. Lond., 1955.

FARM SHOP SKILLS IN MECHANISED AGRICULTURE, by H. O. Sampson and others. Chic., 1955.

TECHNICAL ANNUAL, 1954. "POWER FARMING IN AUSTRALIA AND NEW ZEALAND." Syd., 1954.

CROP MANAGEMENT

CROP PRODUCTION, by R. J. Delorit and H. L. Ahlgren. N.Y., 1953.

FIELD CROP PRODUCTION, by H. K. Wilson and W. M. Myers. Chic., 1954.

WINTER WHEAT IN THE GOLDEN BELT OF KANSAS: A STUDY IN ADAPTION TO SUBHUMID GEOGRAPHICAL ENVIRONMENT, by J. C. Malin. Lawrence (Kan.), 1944.

DISEASES AND PESTS

CHEMISTRY OF THE PESTICIDES, by D. E. H. Frear. 3rd ed. N.Y., 1955.

THE DETECTION AND CONTROL OF GARDEN PESTS, by G. F. Wilson. 2nd. ed. Lond., 1949.

DISEASES OF FRUITS AND HOPS, by H. Wormald. 3rd ed. Lond., 1955.

THE PLANT IN HEALTH AND DISEASE, by W. A. R. Dillon Weston and R. E. Taylor. Lond., 1948.

THE QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK. VOL. 3: INSECT PESTS AND DISEASES OF PLANTS. Queensland. Department of Agriculture and Stock. Brisb., 1951.

SOILS AND FERTILISERS

APPROVED PRACTICES IN SOIL CONSERVATION, by A. B. Foster. Danville (Ill.), 1955.

CHEMISTRY OF THE SOIL, edited by F. E. Bear. N.Y., 1955.

IRRIGATED SOILS: THEIR FERTILITY AND MANAGEMENT, by D. W. Thorne and H. B. Peterson. 2nd ed. Lond. [1955].

THE RESPONSE OF CROPS AND SOILS TO FERTILISERS AND MANURES, by W. B. Andrews. 2nd ed. State College, Miss., 1954.

SOIL FERTILITY, by C. E. Millar. N.Y., 1955.

DAIRYING

MILK WITHOUT TEARS: THE ESSENTIALS OF DAIRY FARMING, by F. Donaldson. Lond., 1955.

TECHNIQUES OF DAIRY PLANT TESTING, by E. F. Goss. Ames (Iowa), 1953.

FRUIT GROWING

BANANAS: CHEMISTRY, PHYSIOLOGY, TECHNOLOGY, by H. W. Von Loesecke. 2nd ed. N.Y., 1950.

MINERAL NUTRITION OF FRUIT CROPS, edited by N. F. Childers. New Brunswick (N.J.), 1954.

LIVESTOCK

THE COW OWNER'S HANDBOOK, by E. T. Baker. N.Y., 1951.

THE FEEDING OF FARM LIVESTOCK, by J. C. B. Ellis. 3rd ed. Lond., 1954.

HANDBOOK FOR WOOL GROWERS. Australian Wool Bureau. 1954 ed. [1954].

HATCHERY OPERATION AND MANAGEMENT, by E. M. Funk and M. R. Irwin. N.Y., 1955.

LIVESTOCK AND POULTRY PRODUCTION, by C. E. Bundy and R. V. Diggins. N.Y., 1954.

BLOWFLY CONTROL IN SHEEP

The Director of Agriculture (Mr. G. K. Baron Hay) stated that a further series of mulesing and tailstripping demonstrations will be held during the next few months. These demonstrations will coincide with crutching operations in the farming areas and the practical instruction given will enable farmers to treat their own flocks.

Mulesing and tailstripping will reduce fly-strike to negligible proportions and farmers desiring demonstrations and instruction in the correct techniques are requested to apply in writing to Sheep and Wool Branch, Department of Agriculture, Perth, or to consult their nearest agricultural adviser.

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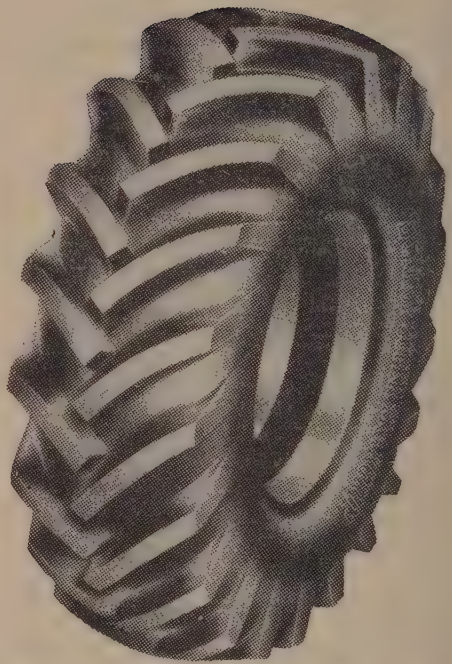

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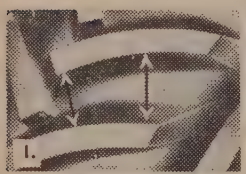

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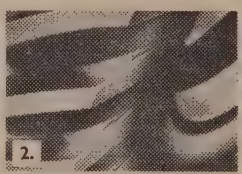

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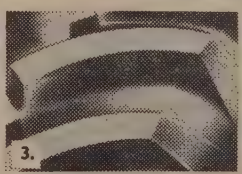

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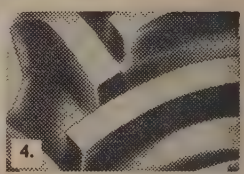

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RABBITS *in the* KARRI COUNTRY

Some Recollections of 30 years of Vermin Control in the Lower South-West

Compiled by C. D. GOODING from Information supplied by W. J. ROONEY

RABBITS first made their appearance in various parts of the Manjimup Road Board District during 1925 and 1926. By 1928, the early arrivals appeared to have consolidated their position and increased rapidly. The areas where rabbits first appeared in serious numbers were Group 119 in the Quinninup area, Groups 123 and 117 at Northcliffe, and Groups 65 and 26 in the Eastbrook, Pemberton and Channeberrup areas. Middlesex and West Manjimup districts were also becoming infested.

Foreword by A. R. TOMLINSON, Chief Vermin Control Officer

"Bill" Rooney has become almost a legendary figure in the sphere of rabbit control in the lower South-West. He has worked very closely with the Government vermin control officers and has been regarded almost as one of them.

He has spent many years of his life in helping farmers in the Manjimup district to protect their properties from the ravages of the rabbit, and has always been a keen advocate of the use of teams of men, with the necessary equipment, to assist in control measures.

It was at Mr. Rooney's request for a solution of the rabbit problem in the Manjimup area that the Agriculture Protection Board carried out its initial work in connection with poisoning teams. Mr. Rooney must feel considerable satisfaction at the success of our Rabbit Control Scheme (using the poison 1080) as going a long way towards the practical application of his theories.

No real efforts were made to eradicate, or even control, rabbits at this period. Rabbits had not formed warrens and the young were mainly born in short, single-entrance tunnels which were carefully concealed and covered over with fresh earth. This was usually referred to as "stop" breeding.

At this stage, foxes had not been seen in the districts but they began to make their appearance early in the 1930's and reaped an easy harvest of young rabbits from the blind breeding burrows.

Probably because of the presence of foxes, rabbits commenced to dig in and constructed deep warrens so that it soon became a rare occurrence to find a shallow breeding tunnel.

In the 1930's, when the depression hit the districts very hard, farming was in the doldrums. Butterfat (first-grade) brought 8d. lb. and the lower grades were almost unsaleable.

Group settlers were thrown on their own resources and being unable to feed themselves, and their families, and at the same time meet their commitments, they began to vacate their properties leaving many areas of pasture unoccupied as a free gift to the rabbits.

Under these conditions, the rabbit hordes increased alarmingly. Of this period Mr. Rooney says, "We began to get alarmed at the menace on our own property. I wrote to the Department of Agriculture several times explaining the situation, and to emphasise my argument I poisoned a nearby vacant property with apple and strychnine and sent a photograph of one night's kill to the then Chief Inspector of Rabbits, Mr. Arnold. (The photograph is reproduced in this article.) Soon after this the authorities began to take an interest in the problem."

Fig. 1.—A typical Manjimup scene showing the difficulties associated with rabbit control in this area—the tall karri trees and the bracken fern

—Photo by C. D. Gooding.

Mr. Rooney said that during this period unemployment was rife and clearing gangs were being given part-time work in maintaining clearings on vacant Group Locations. Some gangs were then placed on the vacant properties to lay poison baits and to dig out rabbit warrens.

As the work was all done by hand it was costly and not very successful. In most cases the area under pasture on each property would not exceed 70 acres, but the cost of rabbit destruction on each holding by this method ranged from £10 to £40 in 1933. A Vermin Inspector was employed for the first time by the Warren Vermin Board. He was paid £5 a week and had to find his own conveyance. The Inspector purchased a secondhand motor cycle and rode it over corrugated roads for six days a week. His initial efforts, directed towards obtaining co-operation from settlers, were a dismal failure—Group Settlers were vacating their properties in large numbers and those who remained could hardly be expected to carry out rabbit control work on their properties while on every side of them abandoned farms served as breeding grounds.

At this time, settlers were offered free supplies of phosphorus poison and pollard to bait adjoining vacant properties. The gesture was well-meant but hardly practicable, and the Chief Inspector of Rabbits realised this when he visited farms almost entirely surrounded by vacant properties.

An offer was then made to provide the wages for three men and to recoup the Vermin Board for poisoning material used on vacant Agricultural Bank properties. Three old IXL poison carts were also loaned to the Board.

The first task was to train men to use the poison carts effectively. The usual practice in those days was to run a single furrow as near as possible to the bush surrounding the pastures. This method only gave mediocre results.

From experience in handling badly-infested areas, said Mr. Rooney, it was soon found that numerous furrows and ample small baits gave the best percentage of kills. As the poison-cart drivers became more experienced, some spectacular results were obtained and Mr. Rooney personally counted over 500 dead rabbits on one small property after the poison cart had been used to lay phosphorised pollard baits.

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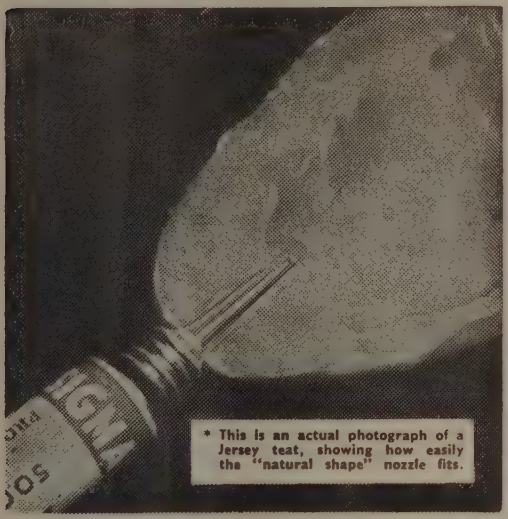

* This is an actual photograph of a Jersey teat, showing how easily the "natural shape" nozzle fits.

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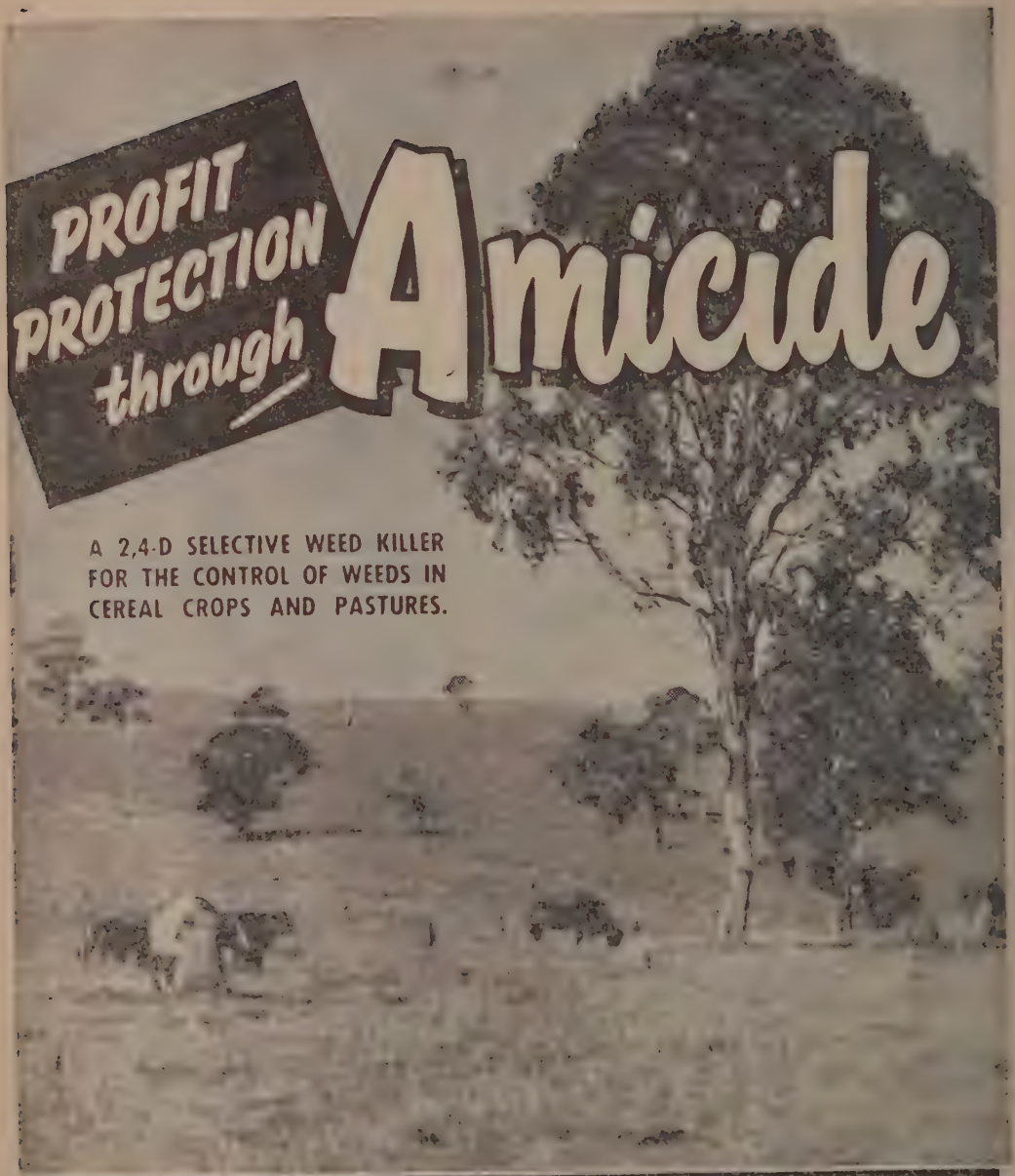

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Some of the settlers were keenly interested in the work of rabbit destruction. Others were antagonistic and their attitude towards the vermin destruction regulations varied from passive resistance to outright hostility.

Eventually, the Vermin Board took legal action against 13 settlers for not destroying rabbits on their properties. The charges were proved and they were fined 5s. each with 7s. 6d. costs. This action forced others to make at least a show of compliance although quite a few furrows were ploughed which were never baited.

THE BOTULISM OUTBREAK

At about this time, botulism (toxic paralysis) took toll of a number of cattle in the Manjimup and West Manjimup districts.

The outbreak was of a particularly virulent type and some dairy herds were almost wiped out. It was not unusual to hear of cows being milked in the evening and found dead outside the yards next morning.

As the deaths followed fairly closely after the use of phosphorus most people who lost stock were convinced that the poison was responsible. Confidence in the use of poisons only returned after successful vaccination against botulism had proved that the poison itself was not the cause of cattle deaths.

As more properties became vacant, it was necessary to employ more poison cart drivers and from about 1934 onward there were usually five to six operating during the summer months. In districts where most of the properties were abandoned, this wholesale poisoning gave spectacular results and in some areas the rabbits were practically wiped out.

In other districts, the haphazard use of poison led to the rabbits becoming "educated" and phosphorus baits were ineffective.

It was decided to follow up the summer phosphorus campaign with autumn poisoning using apples and strychnine, but as all the apples for "free feeding" and poisoning had to be cut by hand, this method was expensive and was only used in badly-infested areas.

Later however, a greatly-increased price for rabbit-skins provided an incentive, and experienced men were supplied with apples and strychnine free by the Vermin Board.

Fig. 2.—Some of the rabbits killed by poison on Mr. Rooney's property in 1932
—Photo W. J. Rooney.

Fig. 3.—Furrow cutting and free feeding as it was done in the "early days"
Photo—C. D. Gooding.

Some of these men made substantial cheques from the sale of rabbit skins and they markedly reduced the rabbit populations.

Practically 100 per cent. kills were obtained at this time where the correct techniques of free feeding and baiting were used.

SOME AMUSING MEMORIES

Mr. Rooney recalls some quaint methods of poisoning used by inexperienced settlers. He found one man preparing apple baits by cutting the fruit into quarters then gouging out a neat hole in each piece of fruit with a pen-nib—being careful to remove a cylindrical piece of apple undamaged. With a fine-pointed knife, he placed some strychnine in the hole and then carefully relaced the plug—a very neat job, but one that hardly made for speed in preparation.

Another settler complained that the rabbits would not eat phosphorised pollard. He had mixed the poison and pollard neat. Given a few hints on the correct preparation of the baits, he failed again—this time by using a whole bottle of oil of aniseed as a lure, instead of the required few drops.

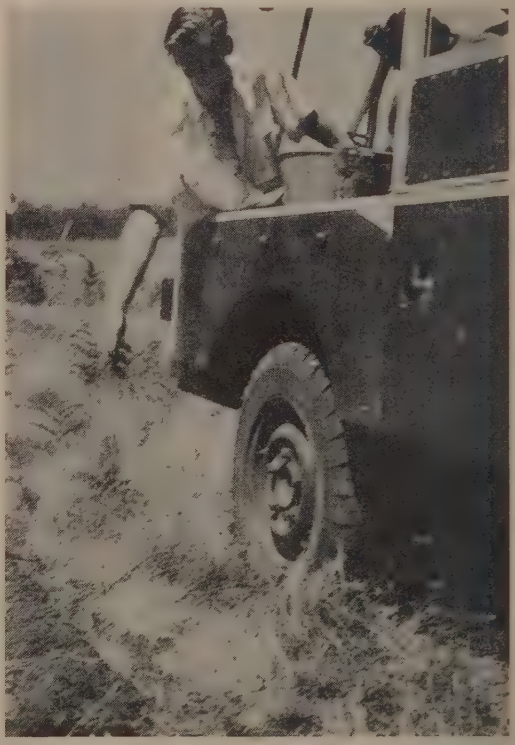

Fig. 4.—Today all the furrow cutting and bait laying done by the Agriculture Protection Board is done mechanically. Here oats are being dropped from a Land Rover into a furrow cut previously by the same vehicle
—Photo by C. D. Gooding.

One man complained that putting out phosphorised pollard was the most tedious job he had ever encountered. He had mixed it as a thin gruel and was trying to splash it into the furrow with a stick!

A German settler suggested that it might be a good idea to throw superphosphate down the rabbits warrens. When asked why he thought it might destroy rabbits, he said, "Vell, she always make my eyes leak."

The mixing of baits in tins that had contained kerosene or sump oil was not uncommon and it took much patient explanation to persuade some of the settlers to adopt tried methods of poisoning.

Fig. 5.—Mr. Rooney inspecting a furrow to check on the poison "take," after a successful "1080" poisoning —Photo by C. D. Gooding.

The poisoning of vacant properties by the Vermin Board with some assistance from the Central Vermin Authority was completely justified. Each poisoning season the majority of settlers would lay poison at the time poison carts were operating, or would ask to have their properties poisoned by the Board's carts. This latter procedure eventually became a severe embarrassment to the Board. Some settlers were inclined to place the sole responsibility for complete control on the Board and became demanding and critical. There would also be a clamour to have the work done at certain times and there was also several claims for damages for stock lost, presumably from eating poisoned baits. Nevertheless, with all its drawbacks, the poisoning of privately-owned properties was justified inasmuch as it gave settlers a working example of the results that could be obtained by using sufficient furrows and ample baits.

During the middle and late 1930's, rabbits had been building up in the Northcliffe district and as about two-thirds of the properties there had been vacated, poison carts were sent each year to poison all these blocks, although, with the exception of a couple of areas, the infestations were generally light.

Whether the initial poisoning campaign took effect before the rabbits became firmly established, or whether some other factor exercised control, is not clear—but the fact remains that rabbits are scarcer in the Northcliffe area today, than they were 20 years ago.

MINERAL DEFICIENCIES

Some years ago, rabbits increased almost to plague proportions on some South Coast grazing leases. The country was good coastal run with numerous flats and gullies carrying various native grasses. The rabbits cleaned out the grasses leaving only the scrub.

Assistance was given the owners to poison with apples and strychnine and while carrying out the free feeding preparatory to poisoning, several freshly dead rabbits were picked up.

They were in poor condition and appeared anaemic. Most of the coastal country is deficient in copper and cobalt, and stock could only be left on the area for a limited period or they developed "coast disease." Rabbits have decreased in numbers over most of this area and mineral deficiency could be the answer.

It is noticeable that where stock were subject to "wasting disease" and "falling sickness," prior to the introduction of Denmark lick, rabbits which built up to nuisance numbers at times, usually decreased gradually.

In the Walpole area, rabbits were becoming very numerous in 1936 but after the area was swept by a severe bushfire in 1937 they disappeared almost completely and have not reappeared in large numbers since. This area is also deficient in certain minerals.

Looking back over the years, the early results obtained with both phosphorus and strychnine were particularly good. As the years passed, the rabbits apparently became more wary and could only be controlled by carefully-planned and well-executed campaigns.

The latest chapter of the story of man's war against the rabbit is now being written, and the new poison—"1080"—is achieving excellent results.

AGRICULTURAL SEED PRODUCTION

Favourable conditions for the harvesting of subterranean clover seed continued during February and in most districts good yields are being obtained and production of certified seed to the end of the month was as follows:—

	Tons.
Dwalganup	630
Mt. Barker	60
Yarloop	162
	852

More than 700 tons were tested and sealed during February, the largest tonnage handled by the Department in any one month. The Great Southern and lower Midlands contributed largely to this total.

The large local harvest and satisfactory yields in other States have resulted in prices being considerably lower than in previous seasons. Quantities of all strains have already been exported to the Eastern States.

Several lines of the Yarloop strain submitted for certification have been rejected because of a germination below the requirement of 70 per cent. This has been due to a high proportion of the seed being scorched when burning to destroy the top growth prior to rolling. Burning of the Dwalganup strain can be carried out with safety as the burrs are buried, but with the later strains varying proportions of the burrs are formed above the soil. A large amount of trash not only causes a severe fire but induces a greater amount of the seed to be formed above ground level. Under such circumstances, if burning cannot be avoided it should be regulated to cause the minimum of heat such as when moist with dew. Firing in sections rather than having a complete severe burn also helps. Where possible the top growth should be removed by other means.

In one case further grading was necessary because of the presence of the Guildford grass seeds.

One hundred and fifty-two bushels of Westralia bean seed have been certified so far this season and one half ton of Phalaris tuberosa temporarily sealed, awaiting germination tests.

Increased production of both Western Australia and New Zealand blue lupins has resulted in a large number of samples being received at the seed testing laboratory. There has been an improvement in pure seed content from previous years but the germination of the Western Australian species has, in the main, been unsatisfactory. Harvesting and cleaning methods are being investigated with a view to improving quality.

The germination of most lines of New Zealand blue lupin produced in the Boyup Brook and Bridgetown districts has been satisfactory. The experience gained no doubt will result in seed of higher quality in future years and it should be possible for production to at least meet the State's requirements.

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IT is a peculiarity of human nature that we are apt to measure the worth of an article by the price we paid for it, rather than according to its practical value. If you are a farmer, this Journal cost you nothing—you didn't even have to pay the postage—but please don't value it any less highly because of that fact.

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All of which brings us to the conclusion that the Journals are well worth keeping so that this wealth of valuable information is readily accessible when it is needed. We have tried to help by including a comprehensive index at the end of each year's issues.

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For those who do not wish to incur the expense of binding—or for those who wish to keep their Journals safe until the full year's issues are available for binding—we recommend the "Journal of Agriculture" filing cases which are available from the Government Printer, Murray Street, Perth, at 7s. 6d. each.

These filing cases offer an inexpensive and convenient method of keeping your Journals clean and readily accessible.

They are strongly made with stout cloth-covered covers, cloth flaps, and tapes. Each case holds a year's issues (six copies) and when the tapes are tied the case may be placed on your bookshelf where it presents the appearance of an attractive volume.

Filing cases are available for Vol. 1 (1952); Vol. 2 (1953); Vol. 3 (1954); Vol. 4 (1955); and Vol. 5 (1956) to take the current year's issues.

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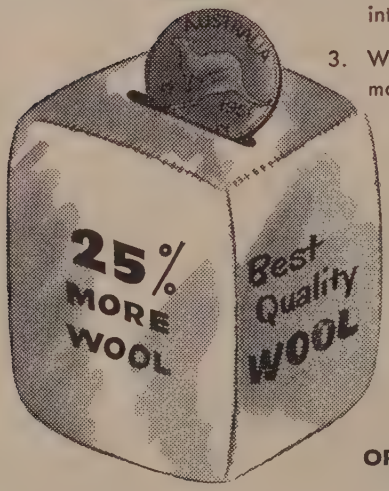

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THE SHEEP ITCH MITE

(Psorergates ovis)

By C. R. TOOP, Chief Veterinary Surgeon

THE sheep itch mite, Psorergates ovis, was recorded in Western Australia for the first time in 1948. This parasite was first detected in New South Wales in 1940 and since that time it has been reported from all of the other States. There is reason to believe, however, that the mite has existed in Australia for many years and that its recognition has been delayed owing to the similarity of the symptoms produced to those resulting from infestation with body lice (Damalinia ovis). The presence of itch mite had been suspected for some considerable time in this State, but a definite diagnosis could not be made until the parasites were recovered from affected sheep and positively identified.

The itch mite inhabits the superficial layers of the skin, setting up a chronic irritation which causes the affected sheep to rub against fence posts and other objects and to bite at the wool, so that the fleece presents a torn and ragged appearance and in advanced cases becomes badly cotted and consequently reduced in value. The itch mite is not visible to the naked eye and its presence can only be detected by the microscopic examination of scraping taken from the skin after the wool has been closely clipped or shaved.

Lime-sulphur dips have proved effective for the control of the parasite, and it has been shown that a single dipping if carefully carried out will completely eradicate the infestation.

The condition has so far only been observed in Merinos.

SYMPTOMS

The symptoms of itch mite infestation are very similar to those produced by body lice and a careful examination is necessary in order that the two conditions may not be confused.

In consequence of the irritation caused by the mites there are symptoms of rubbing and biting at the wool so that the fleece becomes torn and ragged and loose tassels of matted wool may be observed hanging from the sides, flanks and thighs. The degree of irritation appears to be mild and it may be necessary to watch sheep at rest in the yards very closely before any rubbing or biting is observed. Occasionally strands of wool may be found adhering to the teeth or twisted round the horns, and evidence of rubbing may be found on fence posts, logs and trees in the paddock.

The earliest symptom of the condition consists of a small whitish patch on the side or flank, from which the infection spreads in all directions but more commonly towards the hindquarters and over the thighs. The infestation apparently spreads very slowly, and three to four years may elapse before the condition becomes generalised.

The affected wool becomes stringy in appearance and has a dry spiral-pointed tip. It contains particles of crumbling scurf and may show a slight yellow discolouration. The staple is tender and can readily be broken anywhere along its length. In advanced cases the wool becomes badly cotted and the fibres can be torn apart only with difficulty. Sheep in this condition may be difficult to shear and the value of the fleece is seriously depreciated.

COURSE

The spread of itch mite infestation is slow and insidious and several years may pass before it reaches serious proportions in a flock; thus on some properties a few sheep only may be observed to be affected whereas on others up to 20 per cent. may show evidence of infestation. In one flock. which was kept under observation in New South Wales, 15 per cent. of the sheep were found to be affected after a period of eight years.

Sheep of all ages may become affected, but owing to the slow rate at which the infestation spreads, it is most frequently observed in older animals, among which the most serious cases are always found.

The condition is believed to be spread by the direct contact of infested with non-infested animals and to take place soon after the shearing while the wool is short which favours the migration of the parasites. The migration of the mites from woolly sheep appears to be unlikely.

Figs. 1 and 2.—An advanced case of itch mite infestation. Note the torn and ragged appearance of the fleece and the loose tassels of wool hanging from the flanks and hindquarters

DIAGNOSIS

When, in the absence of lice, there are symptoms of rubbing and biting with consequent damage to the fleece, itch mite infestation should be suspected. It should not be difficult to check on the presence of lice since these parasites, although small, will readily be detected when the fleece is opened and examined in bright sunlight.

For the detection of itch mite the microscopic examination of skin scrapings is necessary. The mites are not always present in large numbers, and the examination of a number of scrapings taken from different sites on the body may be necessary before a positive finding is obtained.

When the condition is suspected and confirmation is desired, a sheep showing typical symptoms should be forwarded to the Department of Agriculture for examination.

CONTROL

Experience has shown that itch mites may be controlled by the use of

Fig. 3.—The same sheep viewed from the rear. Note the broad band of wool along the middle of the back which the animal is unable to reach and which appears to be unaffected. The tassels of loose wool hanging from the thighs are very obvious

lime-sulphur dips, and, provided it is thoroughly carried out, a single dipping may completely eradicate the infestation from a flock. Dips containing 1 per cent. polysulphide sulphur are employed and these may be prepared from concentrated lime-sulphur solutions now available on the market and commonly used as orchard sprays. These concentrated lime-sulphur solutions usually contain 20 per cent. polysulphide and when used in a dilution of 1 in 20 will provide a solution of the required strength for dipping. To this must be added a wetting agent such as Agral 3 in the proportion of six ounces to 100 gallons, which will ensure that the dipping solution penetrates and thoroughly wets the fleece. Best results will be obtained by dipping three to four weeks after shearing while the wool is still short, but since lime-sulphur solutions are very irritant to open wounds, treatment should not in any case be undertaken until shear-cuts have completely healed.

Fig. 4.—The Sheep Itch Mite—female—highly magnified. The parasite is too small to be seen with the naked eye

Fig. 5.—A typical sample of wool from a sheep infested with itch mite. Note the stringy appearance and spiral tip

The dips in general use for the control of tick and lice in sheep are not highly effective for the control of itch mite.

Arsenical dips however will destroy large numbers of the mites but without effecting complete eradication and, on properties where dipping in an arsenical preparation is practised as a regular annual routine, itch mite infestation is never likely to become a serious problem.

BULL REGISTRATION

The Director of Agriculture (Mr. G. K. Baron Hay) has drawn attention to the requirements of the Dairy Cattle Improvement Act, relative to the registration of bulls.

The Act provides that all bulls in the South-West Division of the State must be registered, with the exception of pedigree beef strain animals kept solely for beef production, which may be exempted on application to the Director of Agriculture.

Certified Pure-Bred bulls are registered on payment of a fee of 10s. for life, but Grade bulls must be registered annually and a fee of 5s. paid with each application.

Registrations of Grade bulls were due on the 1st of January, 1956, and the Act stipulates that owners who have not complied with the regulations by January 21st, are liable to a penalty not less than £20.

The Department should be notified immediately of the death or transfer of any registered bull.

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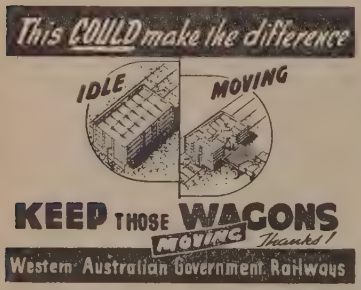

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BATHURST BURR

(Xanthium spinosum L.*)*

Bathurst burr presents a major weed problem in Europe, Asia, America and Australia. It was first introduced to Australia in the tails of horses brought to New South Wales from South America in the forties of last century. Besides having the usual disadvantages of weeds, the burrs cause an appreciable reduction in the value of wool.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

BATHURST BURR

(Xanthium spinosum L.)

BATHURST burr now occurs in most countries, particularly where summer rains are experienced and its original habitat is somewhat obscure although usually regarded as being South America. It presents a major weed problem in Europe, Asia, Africa, America and Australia.

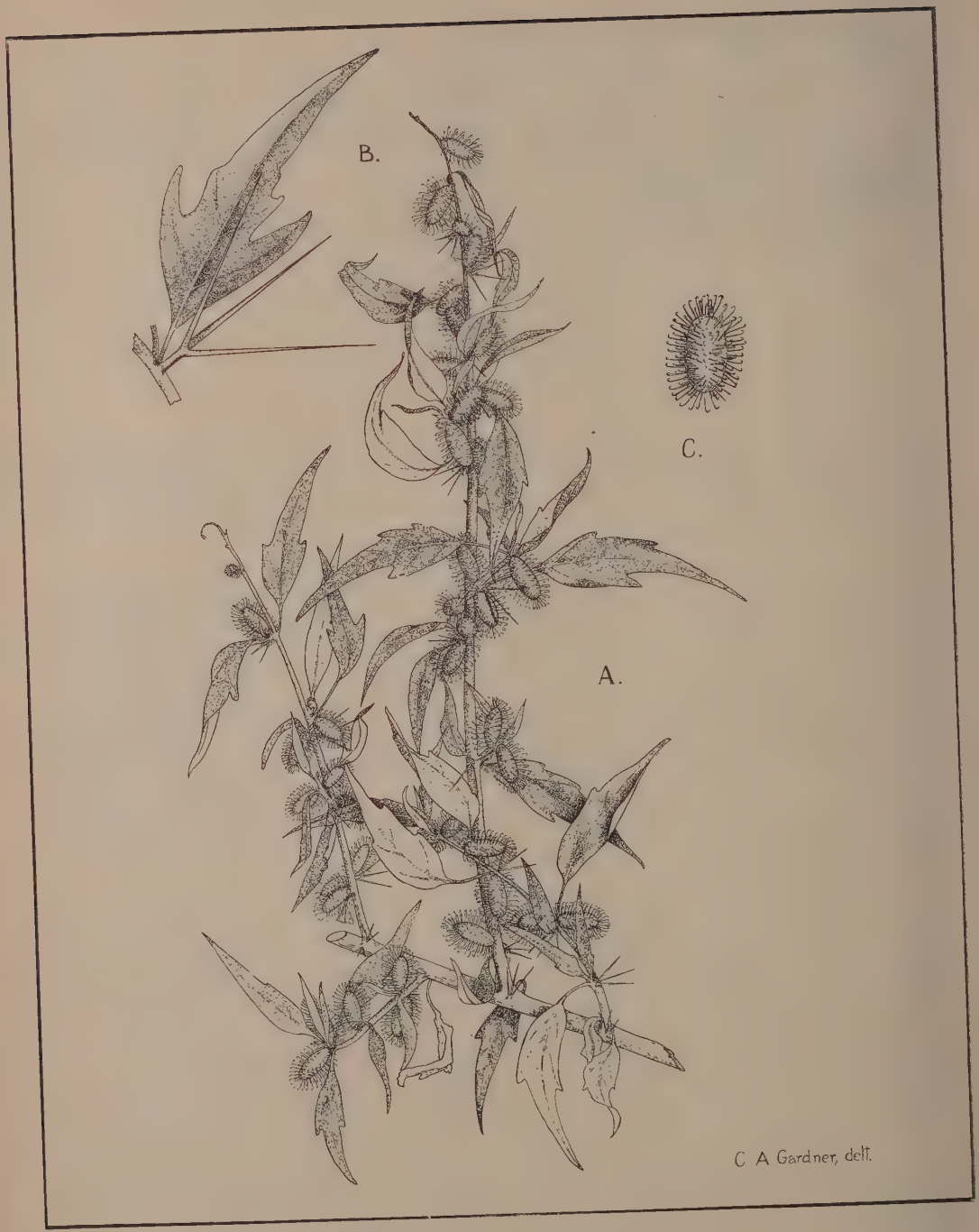
In the "forties" of last century some horses were imported into New South Wales from Valparaiso in South America. Bathurst burrs were entangled in their tails and plants soon appeared at Twofold Bay where the horses were pastured. A few years later the weed was reported from Bathurst, giving rise to the common name, and it has since spread over many thousands of acres being especially prevalent in New South Wales and Queensland.

In Western Australia, Bathurst burr has only become established to any extent in the Eastern Goldfields area, particularly in the vicinity of Kalgoorlie and Coolgardie where it grows vigorously on clay flats which retain moisture following summer rains. Dams and other watering places also encourage its growth. A few plants have been found at a number of places in other districts ranging from Geraldton to Albany and including the Metropolitan area.

Although most of the occurrences can be attributed to burrs carried by animals, particularly sheep, this is by no means the only way in which Bathurst burr has been introduced. Agricultural seeds have always presented a ready medium for the dissemination of weed seeds but as the seeds of Bathurst burr remain enclosed in comparatively large fruits the risk of their remaining in crop seeds would appear to be small. This is essentially true but, during machining, the hooked spines are removed and the smooth fruits containing seeds have been found in large agricultural seeds such as Sudan grass and maize. They have been located more frequently in sunflower, maize and sorghum seeds imported for bird seed and stock food. Burrs have also been found in wool and hides brought into the State for scouring and tanning.

Some years ago a novel publicity method could have had serious results. Firms proposed advertising their goods by means of imitation butterflies having a Bathurst burr as the body. When thrown they readily became attached to clothing. Fortunately the burrs were detected in time to prevent widespread distribution.

The war in the Pacific resulted in some unusual cargoes, bound originally for other destinations, reaching Australian ports and one of the strangest of these could have proved very costly. While other goods were being examined in a bond store at Fremantle some Bathurst burrs were noticed on the floor. A closer examination revealed that they had been spilt from a hole made by rats in a large pack the size of a wool bale. As the Orientals attribute



BATHURST BURR (*Xanthium spinosum* L.)

A—General appearance of plant; B—leaf and three-pronged spine; C—burr, showing hooked bristles.

(From a pen-drawing by C. A. Gardner, Government Botanist.)

some medicinal properties to the burrs, we can only assume that they had been consigned for that purpose. Hundreds of thousands of burrs were promptly incinerated.

Flood waters have proved an important distributing agent, particularly in the case of intermittent waterways. Plants become established in moist depressions and then, following rains, the burrs are swept along the courses of temporary rivers. This sequence of events is demonstrated on a large scale in New South Wales and is also quite apparent on the flats and along the gullies in the vicinity of Kalgoorlie and Coolgardie.

DESCRIPTION

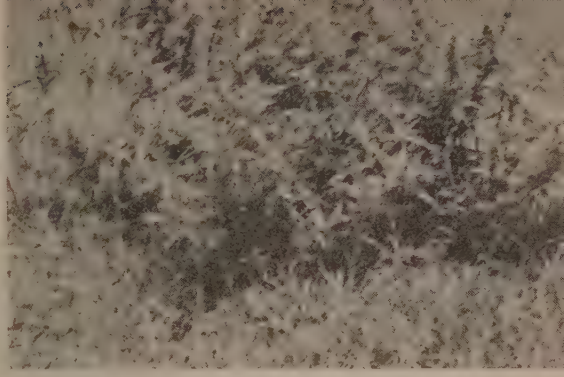
The genus *Xanthium* contains several pest species including Noogoora burr (*X. pungens*) Californian burr (*X. californicum*) and Bathurst burr (*X. spinosum*). Bathurst in New South Wales, one of the first places from which the plant was recorded in Australia, has given its name to Bathurst burr.

It is a rigid, much branched annual of up to 3ft. in height, with greenish-yellow stems and leaves that are dark green above but pale underneath. The leaves are usually three-lobed with the central lobe longer than the other two and bear at their bases rigid three-pronged spines. The flowers are inconspicuous and are succeeded by brown, egg-shaped burrs of about one half-inch in length. These are covered with fine, hooked bristles and each contains two flattened seeds at least one of which may remain dormant for several years. The plant is essentially a summer-growing annual but seeds germinate and plants mature out of season, thus adding to the difficulties of control.

Bathurst burr has been declared a primary noxious weed for the State.

SIGNIFICANCE

There is some evidence that Bathurst burr can prove harmful to stock but, due to its spiny nature, it is seldom eaten and is not usually regarded as being poisonous. On the other hand the related Noogoora burr is known to be toxic, particularly at the young growth stages.



A Bathurst burr plant found growing near a metropolitan wool scouring works

Bathurst burr can interfere with summer crops and pastures but the characteristic that has made it such an undesirable weed is the tenacious nature of the burrs. The hooked spines readily become attached to clothing, bags and animals, especially sheep, and when entangled, their removal is not a simple matter. Sheep present the greatest problem as their fleeces make a very receptive surface for the burrs which depreciate the value of the wool. Bathurst burrs not removed during scouring can usually be crushed and the particles eliminated by special equipment. Although the more costly carbonising treatment necessary for Noogoora burr may be avoided additional work and expense are involved.

CONTROL

Preventing the introduction of weed seeds is always important but particularly when the weed concerned, such as Bathurst burr, has a restricted distribution. All imported commodities likely to contain burrs or have them attached are inspected. Sheep must conform to certain shearing requirements and be accompanied by a certificate of freedom from noxious burrs issued by the Department of Agriculture in the exporting state. They are then carefully examined on arrival at Kalgoorlie or Fremantle. Imported wool and hides are also inspected along with agricultural and bird seeds. Particular attention is given when they are known to be the produce of burr-infested areas.

Plants of Bathurst burr can be destroyed by cultivation and it is a greater problem on pastoral than on arable land. Good results have been obtained in the Eastern Goldfields district by spraying with 2,4-D

ester at the rate of one pound of acid equivalent per acre. The plants are most susceptible when small and, in order to be effective, spraying must be undertaken before burrs have formed.

Odd plants bearing burrs should be removed carefully in order not to scatter them, and the ground examined for any that may have fallen. Building a fire over the plants is often the most satisfactory way when only a few mature bushes are concerned. Even when all plants have been destroyed the site should be kept under observation for several years to cope with the longevity of the seeds. Seedlings are most likely to appear after late spring and summer rains. Under favourable conditions they grow rapidly and mature in a relatively short period.

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CASEOUS LYMPHADENITIS (Cheesy Gland) OF SHEEP

By J. CRAIG, M.R.C.V.S., Senior Veterinary Surgeon.

CASEOUS lymphadenitis is a common disease of sheep in Australia, and is a condition in which hard abscesses, filled with thick cheesy pus, form in the lymph glands in various parts of the body. The term "caseous" refers to the cheesy nature of the pus, and "lymphadenitis" means inflammation of the lymph glands.

The disease is caused by a micro-organism called *Cornyebacterium ovis* which multiplies in the tissues of affected sheep and can produce a toxin or poison.

In most cases, the disease does not affect the general health of the sheep to any serious extent, but it is of economic importance to the meat export trade, as affected glands have to be removed, and this may lead to rejection of the carcass.

METHOD OF INFECTION

The micro-organisms which cause the disease are found in the faeces (dung) of both infected and healthy sheep. They are usually present in large numbers in soil and sheep droppings around shearing sheds and yards, and will survive for long periods under moist conditions when not exposed to direct sunlight.

The micro-organisms usually gain entry to the tissues through skin wounds, such as shearing and mulesing cuts, but occasionally through lamb marking and castration wounds. When newly-shorn sheep lie down on infected soil, or when shearing cuts are exposed to contaminated dust, the risk of infection is greatly increased.

Occasionally the abscesses burst or the swollen glands are cut during shearing, causing the combs and cutters to become fouled with the discharges. Such contaminated hand-pieces readily infect other sheep.

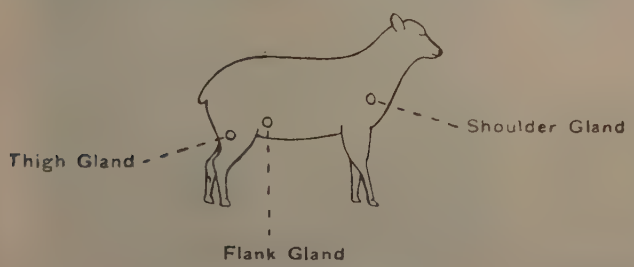

Fig. 1.—Sketch of sheep showing lymphatic glands commonly affected with caseous lymphadenitis

SYMPTOMS

When a cut becomes infected, the germs enter the tissues but are usually arrested by one or more of the lymph glands situated in various parts of the body.

The organisms multiply and an abcess of thick, slightly greenish pus is formed. Gradually, the lymph gland increases in size and the abscess may become enclosed in a tough fibrous capsule—which is the body's attempt to seal off the invading micro-organisms.

If any germs break out, they are carried to the next gland where they form another abscess. The pus changes from a "creamy" to a "cheesy" consistency as the abscess grows older, and may finally become gritty owing to deposits of lime.

When an abscess occurs in a lymph gland near the skin, it may "point" and eventually burst, soiling the surrounding wool with infective matter. Thereafter, the abscess fails to heal and continues to discharge at intervals.

Fig. 2.—Enlarged shoulder gland almost ready to burst. Note shedding of wool over abscess

In the majority of cases however, the pus remains enclosed, but the affected glands, being larger and firmer to the touch than the normal glands, can readily be detected when handling the sheep.

The glands most commonly affected are the prescapular (shoulder glands), precrural (flank glands) and the popliteal (thigh glands). The glands between the hind legs above the udder or cod are less often affected, but lymphatic glands in other parts of the body may become abscessed.

Caseous lymphadenitis may occur between or in the lungs, or on the pleura (the membrane lining the chest cavity). In such cases the disease may lead to septic pleurisy and the adherence of the lungs to the chest wall. Abscesses may occur in the kidneys, liver or other organs, but in many cases animals in which multiple and extensive abscess formation are discovered at post-mortem examinations have remained in good condition and shown no apparent ill-effects.

PREVALENCE

There is a definite age incidence in this disease and old sheep which have been frequently exposed to infection during shearing are naturally more often affected.

Merino sheep, and especially wrinkly Merinos which are more prone to shear cuts than the plain-bodied types, are more commonly affected than British breeds of sheep.

By contrast the disease is rare in unshorn lambs.

PREVENTION

The following recommendations have have been made to cover the main avenues of infection and, incidentally, are equally of value in the prevention of other diseases of wound origin such as tetanus and blood-poisoning:

1. **At Shearing.**—The shearing shed must be thoroughly cleansed so as to remove all dust and dirt. The sheds and boards should be scrubbed down with hot water and washing soda (1 lb. to 1 gallon of water) and then disinfected with some suitable preparation using a bucket spray pump for ease of coverage.

The chutes leading to the counting-out pens should be similarly attended to and any accumulation of sheep droppings, dust

Fig. 3.—Enlarged flank gland

and soil removed from the counting-out pens. Preferably these pens should be concreted, but if not, they may be given a top-dressing of clean soil. Whenever possible, the yards should be watered from time to time while working the sheep to prevent contaminated dust rising and blowing on to shearing cuts.

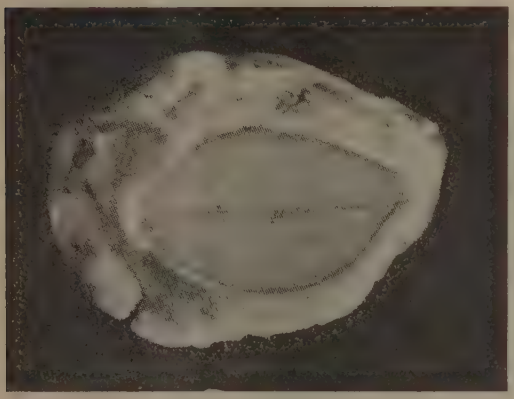

Fig. 4.—Lymphatic gland showing abscess. The gland is surrounded by fat and has been cut open to show the cheesy substance which completely fills the gland

Sheep should be kept in the pens and yards for as short a period as possible after shearing.

Lambs should be shorn first before the machines, hands and yards have the opportunity of becoming badly contaminated.

Sheep with discharging glands should be isolated and shorn separately. The shearing cutters and combs used on those affected sheep should be cleansed and disinfected with hot caustic soda solution, 1 oz. to 2½ pints of water. Lysol or Dettol at the same strength may be used if caustic soda is not available.

These sheep may later be segregated and used for killers, the meat being quite wholesome after the affected glands have been removed.

Every attempt should be made to keep the wounding of sheep down to a minimum and all severe wounds should be dressed with an antiseptic solution to lessen the risk of infection.

2. **At Marking.**—Lamb marking should always be carried out in temporary yards and lambs dropped straight onto a well-grassed paddock. Knives and marking instruments should be sterilised by boiling for ten minutes prior to use and dipped at intervals in a can of disinfectant kept at hand for that purpose.

3. **At Crutching.**—At crutching, and when the modified Mules operation is being performed, every attempt should be made to prevent infection by carrying out the measures described, especially the prevention of dust blowing on to fresh wounds.

VACCINATION

No satisfactory vaccine for use against caseous lymphadenitis has yet been evolved.

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This season, apple powdery mildew has been more serious than usual in many orchards, particularly in the Cleopatra and Jonathan varieties. Once the disease gets a hold it is difficult to check with standard sulphur compounds, which are generally employed for this purpose, and these materials are also prone to damage the fruit and leaves of some apple varieties.

Tests conducted this season by the Plant Pathology Branch of the Department of Agriculture in the Bridgetown, Manjimup and Pickering Brook areas have shown that the new fungicide Karathane is very promising for the control of this refractory disease and also that it appears to reduce mite infestation on the leaves.

It is probable that Karathane, which is now on the test range, will shortly be marketed in Western Australia and it is suggested that when it becomes available, it is worthy of trial by growers, not only against apple powdery mildew but also against related powdery mildew diseases which attack numerous other plants such as cucumbers, peas, and roses.

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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

THE RED-LEGGED EARTH MITE AND THE LUCERNE FLEA

FOR many years the red-legged earth mite (Halotydeus destructor (Tucker)) and the lucerne flea (Smynthurus viridis L.) have been serious pests of pastures and leguminous crops in Western Australia. Under certain seasonal conditions, damage has also been done to cereals such as oats and barley and every year some damage is done to vegetable and flower gardens. Until recently, the control of both the earth mite and the lucerne flea was uneconomic on large areas due to the cost of material and the heavy application rates which were necessary. Recent investigations with new insecticides, however, have completely changed the picture and have provided farmers with cheap and effective methods for controlling both pests.

THE RED-LEGGED EARTH MITE

The original home of this mite is still doubtful. It has been known as a pest in South Africa since 1908, and has been recorded in Western Australia since 1917. Bunbury was the first district to report the pest and it is believed to have been introduced per medium of vegetables and stores discarded from ships trading between the port of Bunbury and South Africa.

Fig. 1.—Red-legged earth mite, greatly enlarged.

Since its introduction the creature has spread practically throughout the South-West, and is a menace to pastures, flower gardens, and vegetables alike.

GENERAL DESCRIPTION

The name, red-legged earth mite, is really very apt, if somewhat lengthy, for it describes the main characteristics of the mite. The tiny body is velvety black, and the legs, eight in number, are red. The two front legs are somewhat longer than the others, and are used as feelers.

LIFE HISTORY

The winter eggs are laid only in suitably moist situations, and may be attached to the under surfaces of plants such as clover and capeweed. Under favourable conditions an egg hatches within a few days and a tiny larval mite emerges. The young mite differs from the adult in its small size and in the fact that, like an insect,

Fig. 2.—Leaf of plant showing typical mite injury.

it has only three pairs of legs. After moulting several times, it gains the full complement of eight legs and becomes mature.

It takes about a month or more, according to weather conditions, for each generation to develop and commence reproducing, so that there is ample time for several generations to arise during the winter.

OVER-SUMMERING

It is only after cool weather and the winter rains have set in that the red-legged earth mite appears, and it soon ceases to be active when the weather becomes hot and dry. It passes the summer by means of resistant eggs which lie in the soil and successfully withstand the heat and desiccation. Many of these eggs are laid before the mite dies, but others remain in the dried bodies of the female mites and hatch with the next winter rains.

HABITS

The red-legged earth mite is rather a delicate creature and is very susceptible to dryness, consequently it is only a pest

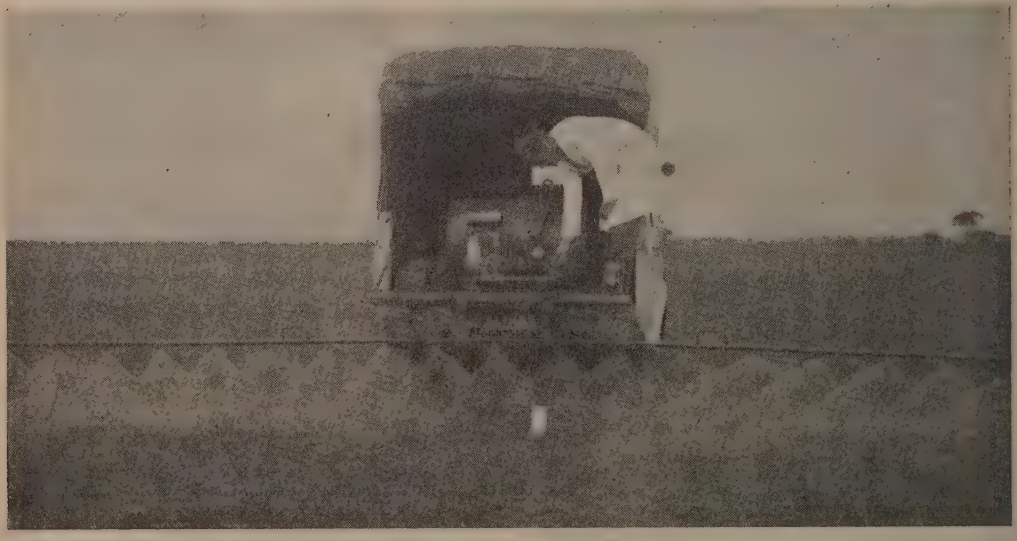

Fig. 3.—The low-volume boom spray has revolutionised pest control methods and provides an effective means of spraying large areas of crop and pasture.

during the winter months. It prefers moist, sheltered situations, and thrives especially where such weeds as capeweed are allowed to grow abundantly.

It is mainly on seedlings that the mite's attack is most serious. As soon as the tiny leaves appear the mites swarm upon them and cause them to bleach and wither. The mouth parts of the creature are adapted for rasping or lacerating the plant tissue, and the exuding sap is sucked up. Typical mite injury is indicated by the silvering or whitening of the attacked foliage, but the absence of actual holes in the leaves distinguishes the injury from the bleaching caused by the lucerne flea.

The mites are gregarious in habits, often feeding in clusters on a leaf or sheltering together in slight depressions in the ground. When disturbed they scatter in all directions, and if on a plant will usually fall directly to the ground.

The name earth mite is quite apt for the creature, as it seldom goes far from that element, and returns there as quickly as possible at the first sign of trouble.

It is on leguminous crops such as field peas and clover that red-legged earth mites are most troublesome to the farmer although flax and linseed may suffer heavily and cereal crops are liable to attack. Under favourable growing conditions it is not usual for crops such as wheat and oats to sustain serious damage but when drought or other adverse factors retard plant growth mite injury is accentuated.

THE LUCERNE FLEA

The lucerne flea or clover springtail is best known in this State as a pest of clover pastures, but various plants, including many types of vegetables, are also liable to attack. The insect is of European origin, being widely distributed over that continent. It occurs also on the North coast of Africa, in the Argentine, and in all the Australian States with the exception of Queensland.

The date of its introduction into Australia is not known, but it was noted in South Australia as early as 1884. It was not until 1910 that the pest was observed in Western Australia, and it is believed that baled fodder imported from South Australia was the medium of introduction.

GENERAL DESCRIPTION

The terms flea and springtail imply that the insect is a good jumper, and this is very true, but the creature is not by any means closely related to the true flea. It does not jump by means of well-developed legs, as does the flea, but with the aid of a special organ known as the spring. Reference to the accompanying illustration will show just how this mechanism works.

The insect is a dumpy-looking creature, wingless and about 1/10th of an inch in length. The colour pattern varies greatly but green or greenish-yellow usually predominates. The mouth parts are of the biting type and the plant material is actually chewed and swallowed.

LIFE HISTORY

The eggs are laid in batches in moist situations either on the soil surface or beneath decaying leaves and debris. After being laid the eggs are covered by the

Fig. 4.—Lucerne flea, greatly enlarged. (After Swan.)

female with a fluid consisting largely of excreted soil, and on drying, this coating renders the eggs very difficult to detect.

In captivity the female has been noted to lay about 60 eggs to a batch and two batches appear to be the average. Under favourable conditions the eggs hatch after three or four days and a "nymph" emerges, resembling its parents in general appearance, but being much smaller in size. The time required for the nymph to develop fully will vary greatly with weather conditions, but is about a month under normal circumstances. As the active period of this pest is approximately from May to October, it is evident that a number of generations can develop during the season.

When warm, dry conditions arise, the eggs fail to develop. They successfully withstand the heat and desiccation of the summer however, and hatch with the first winter rains.

HABITS

The lucerne flea, like the red-legged earth mite, is very dependent upon moisture and quickly succumbs should hot, dry conditions prevail for any length of time. It is seldom a serious pest in sandy localities, but thrives on heavy and slightly acid soils. The reason for this is probably associated with the insect's habit of eating quantities of soil during its life.

The injury caused by the lucerne flea is quite characteristic; small irregular portions of the leaf may be eaten right away, leaving a ragged hole, or the lower surface of the leaf may be left intact as a whitish film.

Although clovers and lucerne are the favourite food plants of the lucerne flea, capeweed is also a very important host plant and often shows severe injury. Vegetables, such as peas, beans and potatoes, grown in close proximity to weedy land supporting a growth of capeweed may be seriously affected.

CONTROL

Cultural Methods

In order to minimise the depredations of both red mite and lucerne flea, all weed growth, especially capeweed plants, should be reduced to a minimum. Where it is possible to plant field crops such as flax, field peas, etc., on clean fallowed land the damage from mites and fleas will be greatly reduced and infestation will mainly arise from weedy fence-lines and head-lands. Where fallow is not available for the planting of susceptible crops, weedy land should be turned in as early as possible prior to planting so that pests already present in the area will be starved out before the new crop has germinated.

In the case of lucerne, early spring planting is sometimes possible. The mite and flea population gradually diminishes with the advance of summer whereas the growing conditions for the lucerne (if moisture is available) become increasingly favourable. By the following winter the plants should be quite well-established and much better able than freshly-sprouted seedlings to withstand both lucerne flea and red-legged earth mite attack.

Biological Control.

No suitable parasite or predator for the control of the red-legged earth mite has yet been found. The position is somewhat more satisfactory, however, with regard to the lucerne flea.

A species of predatory mite commonly known as the bdellid mite (*Biscirus lapidarius* (Kram)) was discovered in this State in 1932 and its main food was found to be the lucerne flea. In permanent pasture lands the mite has shown it ability to exercise a controlling influence on the flea, but it has by no means solved the lucerne flea problem. For many years the mite was distributed by the Department of Agriculture in order to ensure its introduction into the principal clover growing districts. The creature now has a wide range in the lower South-West, and wholesale distribution has been discontinued. The natural spread of the mite is rather slow and some farmers believe in spreading the predators over their paddocks whenever they find a particularly active colony at work. The mite is a little over 1/16th inch in length, reddish in colour, has a long "snout," eight legs, and two prominent "feelers."

It has a habit of hiding, particularly during dry spells, under pieces of bark, slats of wood and other suitable cover. Such material and the adhering mites can

be collected in a bucket or other receptacle and transferred to areas where the flea is particularly troublesome.

Chemical Control.

The increase in ley farming which has taken place in many districts in recent years has greatly accentuated the problem of both lucerne flea and red-legged earth mite control. The general reduction in fallowing and clean cultivation makes farmers more and more dependent upon chemical treatments to ensure healthy crops. Recently developed insecticides and the availability of suitable field spraying equipment has revolutionised pest control methods and has made pasture and field crop spraying a really practical proposition.

Early recommendations for the chemical control of the lucerne flea depended upon such materials as arsenate of lead and lime sulphur (Jenkins and Forte 1948) but the quantities necessary made such chemicals quite unsuitable for field treatments.

Malathion.

Many of the new insecticides have been carefully tested against both the lucerne flea and the red-legged earth mite.

Malathion gives good immediate results against both pests and has the added advantage of being non-toxic to the bdellid mite (Wallace, unpublished information) (Anon 1955). It has a low toxicity to man and domestic animals and may, therefore, be used without the necessary precautions associated with parathion. Unfortunately, there is no appreciable residual effect on pasture pests and so the timing of the spray is very important. Treatments should be applied so as to kill the first brood before egg-laying has taken place. Such an application should normally be made about three weeks after the opening rains.

In order to ensure residual action against the red mite it is best on all occasions to use a malathion-DDT combination in the following proportions:—

½ oz. of Malathion plus 1 oz. of DDT per acre.

Parathion.

Prior to the successful testing of malathion, parathion was the most effective chemical for lucerne flea control, the recommended dosage being ¼ oz. of active ingredient (1/16th pint of 20% emulsion) per acre. At such a concentration, parathion was not effective against the red-legged earth mite and the addition of 4 oz. of DDT (1 pint of 20% emulsion) per acre was recommended. The high toxicity of parathion to man and domestic animals rendered an effective substitute very desirable.

DDT.

Where the red-legged earth mite is not associated with the lucerne flea 4 oz. of DDT per acre will give satisfactory control. DDT is ineffective against the lucerne flea, however, and may even encourage the increase of this pest due to the adverse effect of DDT on the bdellid mite (Wallace 1954 *a*). In most circumstances, therefore, it will be safest to use the malathion-DDT combination already recommended.

OTHER NEW INSECTICIDES

Benzene-hexachloride (BHC or "Gammexane") gave some promise in early experiments (Jenkins and Forte 1948 and

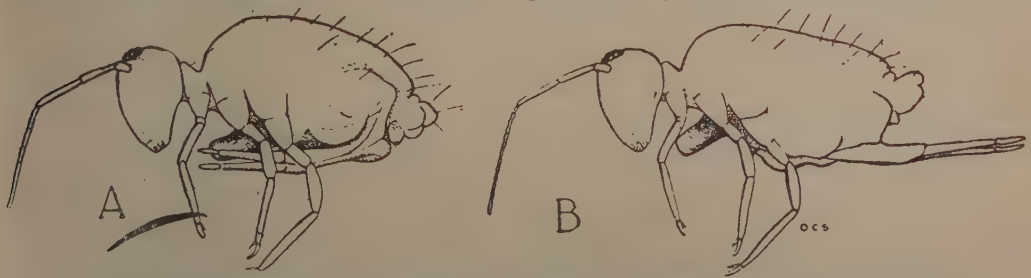

Fig. 5.—Sketches of lucerne flea showing the mechanism of the spring. (a) Spring folded under body in the normal position. (b) Spring extended after jumping. The structure projecting from between the middle pair of legs is the base of the ventral tube (adhesive organ). Only the appendages on the near side are shown.

(After Swan.)

Swan and Lower 1951) but subsequent work has shown it to be of little practical use (Wallace 1954 *b*) especially in view of the remarkable effectiveness of parathion and malathion.

Lindane spray at 1.1 and 2.3 oz. per acre gave no control of the lucerne flea but fair control of the earth mite. The latter, however, was in no way comparable to the DDT treatment either in early or residual effect. (Wallace, unpublished information.) (Anon 1955.)

Dieldrin at 4 and 8 oz. active ingredient per acre applied by boom spray was not effective against earth mites and gave only fair immediate control of the lucerne flea. The residual effect against the latter pest, however, was good. (Wallace, unpublished information.) (Anon 1955.)

Tests have been carried out with a number of other new insecticides (Wallace, unpublished information) (Anon 1955) including endrin, dilan, chlorthion and diazinon. None was comparable with DDT for the control of the red-legged earth mite, but chlorthion proved equal to malathion for lucerne flea mortality. Endrin gave a good immediate kill of both pests with some residual effect against the earth mite.

Individual and Combined Treatments for Red-Legged Earth Mite and Lucerne Flea Control

Where red-legged earth mite alone is troublesome, DDT at the rate of 4 oz. (1 pint of 20% emulsion) per acre may be used. For lucerne flea control, malathion at the rate of ½ oz. of active ingredient (2 tablespoonfuls of 50% emulsion) per acre should prove effective.

As both pests are commonly associated in pastures, however, a combination of ½ oz. of malathion, plus 1 oz. of DDT (¼ pint of 20% emulsion) per acre is recommended for general pasture spraying.

Method and Time of Application

Spraying.

Low volume sprays and aircraft have been effectively used to apply materials for lucerne flea and red-legged earth mite control. As already stated, if one spray treatment only is contemplated it must be carefully timed to kill the newly hatched fleas before egg-laying has commenced. The residual action of the DDT against red-legged earth mite makes the timing less important with regard to that pest. When the first spray has been delayed or wrongly timed with regard to lucerne flea, a second treatment three weeks after the first may be necessary to control a bad

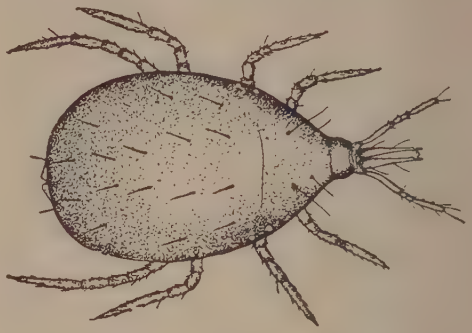

Fig. 6.—The bdellid mite, greatly enlarged.

outbreak. The spray should be carefully applied so that patches are not missed here and there in the pastures. Pests can spread out from such places and re-infest sprayed areas. The amount of liquid applied per acre will depend upon the type of equipment used. Aerial treatments with about 2 gallons of spray per acre have proved satisfactory, but with ground equipment from 5-10 gallons per acre are usually applied. The performance of any spray outfit should be carefully tested before spraying is actually commenced. A 30 foot boom, however, will do about 20 acres per hour at 5 miles per hour.

Top-dressing.

Superphosphate mixtures containing DDT and lindane have been tested against both the lucerne flea and the red-legged earth mite with varying results (Anon 1953; Erlich 1954; Wallace 1954 *a*). Good control of the red-legged earth mite has been obtained with DDT-superphosphate applied after the opening of the season and when mite activity had commenced. The results obtained from late summer top-dressing on dry pasture paddocks, however, have been unsatisfactory. Superphosphate-lindane mixtures have not given effective control of the lucerne flea under local conditions.

Necessity for Treatment.

It has been shown (Wallace, unpublished information) that an overall gain of 14% in total yield can follow the elimination of the red-legged earth mite from clover pastures. Where heavy mite and flea infestations are observed early in the season, therefore, spray treatments should be well worth while. On the other hand the wholesale spraying of uninfested or lightly infested pastures, as practised by many farmers, as a general preventive measure, is neither economical nor desirable.

WARNING

Operators handling parathion and other dangerous insecticides should follow the safety precautions recommended by the Department of Public Health and printed on the insecticide containers. Contact with liquids should be avoided, and the spray mist should not be inhaled.

Stock should be excluded for at least a week from paddocks treated with such materials.

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FOX POISONING

Numbers of foxes are still being destroyed in areas covered by the "1080" rabbit poisoning units. Some were dying as the result of eating poisoned rabbits (secondary poisoning) but many cases of primary poisoning occurred where farmers use poisoned apple baits instead of oats.

Tests were recently conducted in the Geraldton and Moonyoonooka areas in an attempt to determine which baits were most acceptable to foxes. Baits tested included fats (mutton, beef, lard and butter) fruits (dates, raisins, apricots and apples) and cereals (bran and pollard).

Beef and mutton fats proved superior to butter, while lard baits were left untouched. Dates were the best of the fruit baits but were only about one-third as attractive as the fats. Except for a few raisins, the remainder of the fruit baits were left, untouched.

A furrow trail was not found to be particularly effective in this area as most foxes appeared to travel along gullies. However where a furrow intercepted the fox trails the track indicated that the animals often followed the furrow for a short distance. Where a sheep paunch was trailed along the furrow a slight increase in activity was noticed.

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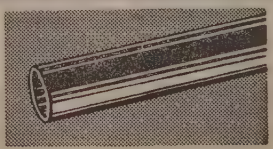

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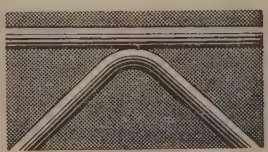

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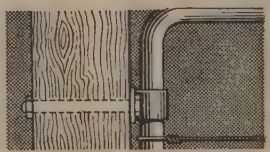

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RECENT ADVANCES IN THE DEVELOPMENT AND USE OF INSECTICIDES

By C. F. H. JENKINS, M.A., Government Entomologist

IN recent years the use of insecticides has become such an everyday feature of modern agriculture that it is difficult to imagine the husbanding of crops and stock without the aid of chemical dusts and sprays. It is not long ago, however, that something more akin to black magic than science was depended upon to protect agricultural products, with results that left much to be desired.

The Chinese are credited with making the first use of arsenic as an agricultural spray as early 910 A.D., but it was not until the end of the last century that a truly scientific approach was developed towards the use of insecticides.

During World War II what might be called an insecticide famine occurred in almost all countries, and this resulted in an unprecedented stimulus to research on insecticides and allied products. The amazing success which crowned much of this work is common knowledge and has aroused public interest as never before in insect control.

The most outstanding of the new synthetic organic insecticides was DDT, but it was soon challenged by many later developments, the full potentialities of which are still being explored.

THE CHLORINATED HYDROCARBONS

Among the new materials now available to combat both insects and mites may be mentioned benzene hexachloride, (more familiarly known as BHC or gammexane,) chlordane, aldrin and dieldrin. These chemicals are known collectively as chlorinated hydrocarbons and they all possess certain common characteristics. For instance they are extremely toxic in very small doses to certain creatures but relatively ineffective against others. Their residual action is such that treated surfaces may remain lethal to susceptible insects for weeks and even months after treatment.

Unfortunately, however, some insects have shown a tendency to develop a resistance to this group of chemicals and serious complications have resulted. Furthermore, various mites are largely unaffected by DDT and its allies, whereas many natural parasites and ladybirds succumb readily to such materials.

This means that none of the DDT-dieldrin group should be used indiscriminately to control insect outbreaks. Each material has its particular virtue and should be used only where it will give best results. DDT, for instance, is effective against most plant-infesting caterpillars and in consequence is widely used in market gardens and orchards. It will also control the red-legged earth mite at rates of as low as 2 ozs. of DDT per acre so that the status of this pasture pest has completely changed since the advent of DDT. Dieldrin has shown itself pre-eminent in the control of Argentine ants and grasshoppers and has been extensively used in Western Australia during the past few months against both these pests.

THE ORGANIC PHOSPHATES

It is not possible in an article of this nature to itemise the various uses to which each of the new materials may be put. My purpose is rather to illustrate the necessity for discriminating between the various chemicals and to combat any tendency to regard a particular ingredient as the solution to all insect problems.

Comparable in importance to the chlorinated hydrocarbons of the DDT-dieldrin group of insecticides are the organic phosphates. Well known names in this group are parathion or E.605, H.E.T.P. or hexone and malathion.

Parathion has a very wide range of uses; it is effective against many types of caterpillars, aphis, mites and the lucerne flea. Unfortunately, however, it is highly toxic to human beings and the health hazard has always militated against the use of this very efficient insect destroyer.

Malathion which has been used recently in an anti fly campaign in Perth is one of the latest recruits to the ranks of the new insecticides. It has many of the properties of parathion, but is much less dangerous to human beings. Mixed with sugar and water, it makes a very effective fly bait and as a contact spray has already proved itself in several directions.

SYSTEMIC INSECTICIDES

A group of chemicals which are still very much on the experimental list are known as systemic insecticides. These materials are actually absorbed into the sap-stream of the plant, rendering the foliage and more particularly the growing shoots toxic to sucking insects. The materials may either be sprayed onto the plants or watered around the roots. Unfortunately, most of the systemics are very toxic to the higher animals. This means that until much more is known about the movement and persistence of these chemicals within the plant tissues, they can have only a restricted use. They may be dangerous if used on fruiting trees or on vegetables and so at the present time are recommended mainly for the treatment of ornamentals.

The new insecticides can only get a very brief mention. They include the benzene sulphonates such as elimite, ovatran and their relatives. These materials are very selective in their section and, although harmless to most insects including parasitic wasps and ladybirds, they show a marked toxicity to the eggs and immature stages of certain fruit tree mites.

In these parts of the world where repeated DDT sprays have been regularly used for the control of codling moth, on apples and pears the increase in mite numbers has been a serious problem. What can occur has been exemplified locally where heavy DDT schedules have been

applied in the eradication campaigns against the Codling Moth at Mullalyup and Nannup and the Oriental Fruit Moth in the Bickley Valley. But generally speaking this problem has not developed to serious proportions in this State.

FUMIGANTS

In the realms of fumigation also important progress has been made Methyl bromide is being used increasingly for protecting stored wheat and other grain from weevil attack and has also proved to be an important soil fumigant. Ethylene dibromide is another material which has been used successfully to fumigate ripe fruit to prevent the development of fruit fly.

Preliminary tests carried out in Western Australia in the last couple of years indicate that ethylene dibromide fumigation may remove the necessity for some of the restrictions on fruit transport not only within the State but to overseas markets as well.

Developments in new machinery and application techniques have also shown great progress in the last few years. Low volume boom sprays now make it possible for liquids to be applied at rates of as low as 1 gallon to the acre. The use of spray booms up to 40ft. long means that large areas can be done quickly and relatively cheaply with motor vehicles and tractors, or that aeroplanes and helicopters can be satisfactorily used where the crop to be sprayed is sufficiently extensive.

One of the latest developments for use both indoors and in the field and orchard is the aerosol. Insecticides such as DDT are atomised under pressure and produce what amounts to an insecticidal fog. The particles are so fine that they take a long time to settle and are particularly effective against small flying insects.

Aerosol types of spray are now quite popular locally for fly control and are both convenient and effective but perhaps a little expensive.

In the fumigation field the development of durable and gas proof plastic sheeting has greatly facilitated the treatment of various commercial products in recent years. At one time a solid gas proof structure was almost essential excepting in the case of citrus tree fumigation where canvas tents were found to be adequate. Now plastic sheets and envelopes can be adapted to a variety of purposes and as many of you may recall nearly 4,000,000 super feet of imported timber was fumigated under plastic tents at Fremantle a few years ago to prevent the establishment of the sirex wasp.

From the foregoing it will be seen that the wide range of new insecticides and miticides which have been developed in the last ten years have aided considerably in subjugating many of our major pests. New and complex problems have come hand in hand with these modern materials, however, and many puzzles still await solution. The increased tendency for resistant strains to appear in many insect groups and the biological upsets which sometimes follow the use of DDT and its allies show that the insects have not given up the fight and that they are likely to remain dangerous and resourceful adversaries for a long time to come.

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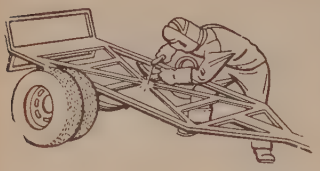

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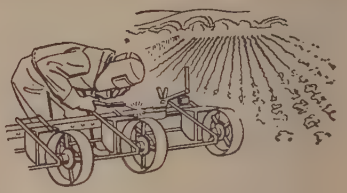

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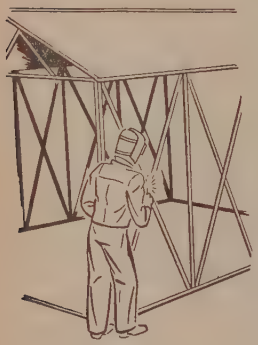

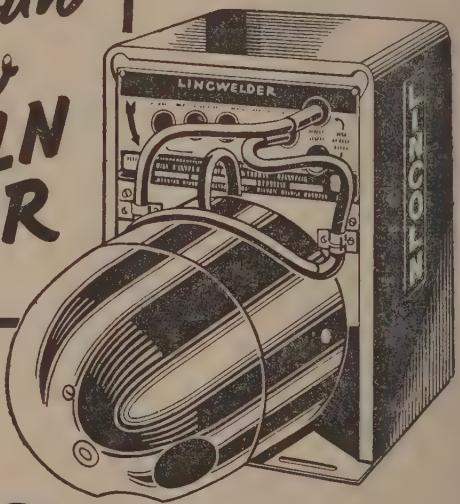

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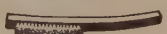

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PLANT DISEASES

DOWNY MILDEW OF ONIONS

Results of Further Spray Trial

By R. F. DOEPEL, B.Sc. (Agric.), Plant Pathologist

FURTHER spray experiments conducted this season have confirmed the value of zineb fungicides for controlling the serious downy mildew disease of onions. In these experiments plants sprayed with zineb yielded 20% more marketable onions than unsprayed plants and the disease was also greatly reduced in seed crops.

Although downy mildew develops each year in spring and early summer onion crops and causes considerable losses, growers have seldom applied fungicidal sprays as a routine measure. Where sprays have been applied, lime sulphur-resin soap has been the most widely used material.

In preliminary tests conducted on a summer crop at Spearwood during the 1954 season, the organic fungicide zineb proved superior to a number of spray materials, including lime sulphur-resin soap, for mildew control.*

SYMPTOMS AND EFFECTS

Leaves affected with mildew turn yellowish green and wither back from the tips (Fig. 1). The disease is most noticeable on the older leaves but the younger leaves are also attacked as they develop. The fungus can often be seen as a grey-violet downy covering on the leaves in the early morning after rain or dew (Fig. 2). If leaf damage is severe, bulb development is retarded and yields are lowered.

Fig. 1.—Onion plants in an experimental plot at Spearwood showing leaves attacked by mildew. Affected leaves turn greenish yellow, hang down limply and wither back from the tips.

* Refer.—Journal Dept. of Agric., West Aust., Vol. 4 (Third Series) No. 3, pp. 313-318.

Seedstalks are also attacked by mildew (Fig. 3) and commonly bend over or break at the site of infection (Fig. 4). As a result, seed quality and yields are greatly reduced.

TESTING OF SPRAYS, 1955

Further experiments were conducted this season on both field crops and onions grown for seed. Zineb and copper oxychloride were the only fungicides tested, each material being used with and without Triton B 1956, an additional wetting and spreading agent.

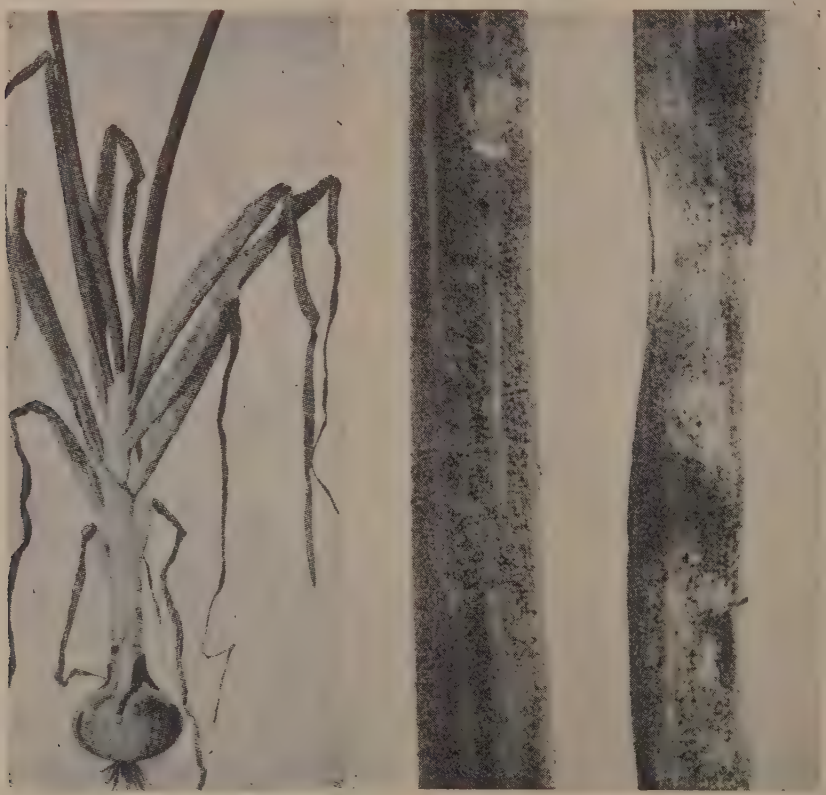


Fig. 2.—On left, typical appearance of onion plant badly affected with downy mildew. (After Walker.) On right, portions of onion leaves showing the furry growth of mildew which is most noticeable in the early morning after rain or heavy dew.

EXPERIMENTAL DESIGN AND TREATMENTS

Field Crop.—Eight beds of onions were selected from a very uniform stand in a late July planting in the Spearwood district. The experiment was of a random block design with eight replications of each treatment. The plots were two beds in width (four rows of plants per bed), and 12 links in length. Unsprayed strips of onions were left between the plots to encourage mildew development.

Spray strengths of the fungicides and spreader used were as follows:—

Material.	*Strength (in 100 gallons water).*
	lb.
Copper oxychloride	3⅓
Zineb	1½
Triton B1956	6 fluid oz.

Commencing on September 13, five spray applications were made with a knapsack sprayer to be the experimental plots at 10 to 14 day intervals. The control plots were left unsprayed as a check on the performance of the fungicides.

Seed Crop.—The zineb + Triton spray was also tested on a seed crop of onions at Spearwood. Seven applications were made at 10-14 day intervals. An unsprayed section of the crop was left as a control.

DISEASE DEVELOPMENT

Mildew developed in all experimental plots and caused dying back of the leaves, particularly on the unsprayed plants.

Fig. 3.—Onion seedstalk affected with mildew—early stage. The portion of the stalk showing white has been girdled by the fungus.

Seedstalks were affected by the mildew at a late stage of growth, many of them withering and falling over at the site of attack.

PLOT RECORDS

Field Crop.—An assessment was made a week prior to harvest, of mildew damage to the foliage in each treatment plot. The following table gives the average estimates of leaf tissue killed for each treatment.

TABLE 1.

Treatment.	*% Leaf Tissue killed (Average of 8 plots. 5 plant per plot).*
(1) Control—unsprayed	38.75
(2) Copper oxychloride	35.00
(3) Copper oxychloride + Triton	37.88
(4) Zineb	31.00
(5) Zineb + Triton	28.75
Least significant difference 5% level	6.26
Least significant difference 1% level	8.43

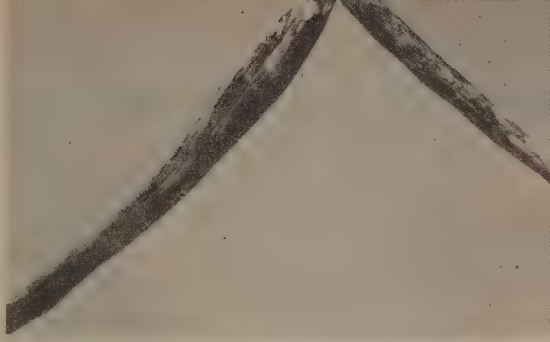


Fig. 4.—Onion seedstalk affected with mildew—late stage. The stalk has withered and bent at the site of attack.

All plots were harvested at maturity on November 23, 1955, and the onions were cured for a week before being topped and weighed. The total yields for the various treatments are listed in the following table:—

TABLE 2.

Treatment.	*Yields of Cured Onions (Average of 8 plots).* lb.
(1) Control—unsprayed	43.94
(2) Copper oxychloride	43.63
(3) Copper oxychloride + Triton	43.18
(4) Zineb	53.06
(5) Zineb + Triton	53.38
Least significant difference 0.1% level	5.29

Seed Crop.—Counts were made of healthy and mildew affected plants in the experimental block:—

	No. affected seed-stalks.	Total No. stalks.	% affected.
Unsprayed plot	418	735	56.9
Zineb + Triton plot	51	780	6.5

DISCUSSION

The zineb sprays were the only treatments that significantly reduced leaf damage from mildew and increased yields of marketable onions. Plots sprayed with zineb gave approximate 20 per cent. increases in yields above those of the copper oxychloride and control treatments. Improved coverage of plants was obtained by using Triton spreader with the fungicidal sprays.

Outstanding control of mildew on the seedstalks was also obtained with the zineb + Triton spray.

RECOMMENDATIONS

1. Spraying.

From the results obtained during the past two seasons experiments a zineb spray is recommended for controlling downy mildew on both field and seed crops of onions. The fungicide should be used at a strength of 1½ lb. in 100 gallons water. To obtain good coverage, an efficient wetting and spreading agent, such as Triton B1956 or Agral LN, should be added to the spray at the rate of 4 to 6 fluid ounces in 100 gallons spray.

The first sprays should be applied before mildew develops and then at 10 to 14 day intervals during the season.

Zineb is marketed under such trade names as Dithane Z-78, Zebtox, Zineb 65, etc., and can be obtained from leading seedsmen and stock firms.

2. Sanitation.

As crop remains may serve to carry over the mildew fungus from season to season, all dead leaves and discarded bulbs should be burnt after harvesting has been completed.

3. Rotation.

Onions should not be grown more frequently than once every three years on the same land. This will help prevent infection of seedlings, field and seed crops from diseased refuse in the soil.

ACKNOWLEDGMENTS

Grateful appreciation is expressed to Messrs. Rudan and Gaspar of Spearwood for making available onion crops for the experiments.

Acknowledgment is also made of the assistance given by Messrs. M. Hardie, T. Wachtel and H. Leitch, of the Vegetable Branch in applying the sprays and harvesting the plots, and by Mr. N. Shorter, of the Horticultural Division for analysing the experimental results.

KANGAROO DESTRUCTION

Although kangaroos are protected in some parts of the State, they are classed as vermin in the pastoral areas where vast numbers are eating out valuable feed needed for sheep.

The Chairman of the Agriculture Protection Board (Mr. G. K. Baron Hay), said that some pastoralists were making strenuous efforts to reduce the numbers of the pests, but still more co-operation was needed to produce worthwhile results.

In the Wiluna area, 600 kangaroos were poisoned on Mt. Keith Station, and at Albion Downs Station 2,200 had been destroyed in three weeks.

In the Meekatharra area where a bonus of 1s. 6d. a head was declared in August, 1954, a total of 10,780 kangaroos have been destroyed to date. Poisons used include, strychnine, arsenic and cyanide and methods recommended are designed to prevent loss of bird life.

Fig. 1.—Contour banks are often needed to control erosion on sloping land. They break up a long slope into a number of short slopes so that when run-off does occur, the water runs downhill a short distance only before being carried slowly across the slope to a safe waterway. Soil fertility and plant cover must be maintained because earthworks alone are not enough to prevent erosion

SOIL CONSERVATION IN WESTERN AUSTRALIA, 1946-1956

By G. H. BURVILL, M.Ag.Sc., Commissioner of Soil Conservation

A LITTLE more than ten years ago, Parliament in Western Australia passed a Bill, for an Act Relating to the Conservation of Soil Resources and the Mitigation of Erosion. The Soil Conservation Act, as it is generally called, was assented to on January 9, 1946, and was proclaimed in July of the same year. We can now look back over the ten years since the Act was considered by Parliament. What were the reasons for this Act? What have been its effects? What is the future of soil conservation?

Soil conservation is now a common term. Twenty-five years ago it was seldom used even though many of its principles were well known at that time. These are the principles of good farming and wise land use. Soil conservation is best defined as "systems of land use which will keep soil in place, and will maintain or improve its fertility or productivity." The dictionary definition of the term "conservation" implies treating or handling things with an eye to their future usefulness. It may not strictly include "improvement," but soil conservation authorities throughout the world like to aim beyond the mere maintenance of soil fertility.

THE IMPORTANCE OF SOIL CARE

Throughout the world, the proper use and care of soils assumes greater and greater importance, to provide foods and fibres, as well as warmth and shelter for the rapidly increasing population. There is no large-scale alternative to soil for

Fig. 2.—Gully erosion caused by uncontrolled run-off of water from sloping lands is quite common on Western Australian farmlands, but fortunately is not severe in many places. It must be taken as a stern warning however

plant growth. The prime responsibility for soil care lies with farmers and pastoralists who own or use the land. They use it principally to make a living, but they should always consider its productivity over a long period, as well as immediate returns.

Soil can be conserved, but it can also be quite easily destroyed by faulty farming methods. It is only a thin outer layer of the earth's crust. The two main agents of soil destruction and removal are moving water and moving air, or wind. These two cause soil erosion if poor farming and grazing methods allow them. Soil erosion has become so widespread and common in the world that many countries now have Acts of Parliament and Government agencies with power to control faulty land use methods. These organisations' main work is, however, giving advice and assistance to farmers with erosion and conservation problems.

SOIL CONSERVATION IN AUSTRALIA

Here then we have the background for the Soil Conservation Act of 1945:—Growing concern in many countries about soil erosion; great publicity to the "dustbowl" conditions in United States in the mid 1930's; the development of the great United States Soil Conservation Service. Nearer home, evidence of soil erosion by water and wind becoming all too common on the State's farmlands. Other Australian States, New South Wales, Victoria and South Australia had already felt that erosion problems demanded attention in the State's interests. A Western Australian Soil Conservation Committee was appointed in 1936. Its survey and review of erosion problems over a number of years led to the drafting of the Soil Conservation Bill, introduced to Parliament by the Honourable F. J. S. Wise, who was then Premier of the State.

Departments of Agriculture in the Australian States have, for many years, devoted much effort to finding methods of maintaining and improving soil fertility, and have made advice freely available to farmers. But farmers, and communities generally, do not think seriously about soil conservation, until soil erosion becomes quite active. The attitudes and actions of farmers should be the most powerful force in achieving soil conservation and soil erosion control. Most governments now organise special advisory services on erosion problems. This may not be sufficient. The national importance of soil to the country's survival and wealth makes it necessary to have power to compel proper action by individuals, some of whom may be willing to stand by and watch land which they own, being gradually destroyed by erosion.

The Soil Conservation Act contains powers to deal with cases where persons will not act voluntarily to protect their lands. Such power is not often required, but must be available—in fact it has only been used once in the past ten years.

WEST AUSTRALIAN PROGRESS

The Soil Conservation Act provided for a Soil Conservation Service branch to be set up in the Department of Agriculture to deal with the special problems of soil erosion and soil conservation in the State. The branch was started in 1946 with Dr. L. J. H. Teakle as the first Commissioner of Soil Conservation. The time since then has been a difficult period for recruiting professional and technical staff, but with the men available, the Soil Conservation Service believes it has made good progress with its functions. The Commissioner and seven other University graduate officers, assisted by three technicians with Muresk

Agricultural College diplomas, are now available to deal with general soil erosion problems. Five other officers are engaged on soil research, mainly relating to the salt problem.

The very wet winters of 1945 and 1946 showed many farmers how soil erosion by water could occur, especially on cereal growing areas. There was plenty of earlier erosion, too. But from the outset, the Service has never been content to try only to heal erosion wounds. It has emphasised the need to give thought to all aspects of land use on a farm, so that effective and complete soil conservation might be achieved. Work on individual farms has been mainly, but not entirely, in the 15 to 25-inch rainfall belt, where the climate, topography, soils and extensive cropping with cereals, combine to give the greatest erosion hazards. Seven hundred and fifty farmers have been advised on specific erosion problems on their farms. Two hundred and forty have constructed earthworks for erosion control or to control water movement. Contour working, with all cultivation on the level, has been applied on 18,000 acres. A further 20,000 acres has been protected by contour banks of earth. Seven hundred acres of pasture land has been treated with contour pasture furrows. In orchards and vineyards contour practices are in use on 165 acres.

These figures may sound small when we consider the millions of acres of farmlands and the thousands of farmers in the State. They *are* small, but they represent the specific records known to the Soil Conservation Service of definite attention to erosion problems. The need for soil conservation has been brought before hundreds of other farmers by field days, farmers' schools, radio broadcasts, leaflets and articles. Self help is encouraged. Complete farm planning for soil conservation is a new development in which a number of farmers is showing keen interest. District organisations like Pasture Improvement Groups, Junior Farmers and Road Boards are showing greater interest in soil conservation in several areas.

Fig. 3.—Cereal rye is a useful crop on sand drift and wind-eroded areas. Here a fence has been half buried by soil drift

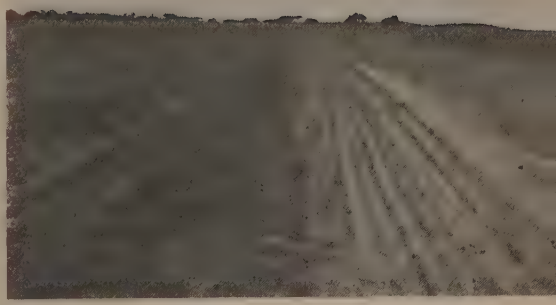


Fig. 4.—Subterranean clover is helping to improve soil fertility in Western Australia. This photograph shows light land at Wongan Hills sown to clover 1941, except the light coloured strip. The clover was ploughed and seeded to wheat in autumn 1947, and yielded better than 30 bushels an acre. In 1948 wheat was again seeded. Note better crop and darker soil where five years of clover pasture has added organic matter to the soil. Photo taken on June 23, 1948

When the Soil Conservation Service commenced field operations early in 1947, two successive wet winters had caused much erosion and demands for help were numerous. Methods of attack were adapted from those successfully used in other States. In the past eight years heavy rains have tested many jobs involving earthworks, and in general they have been entirely effective. Even five to ten inches of rain in three days in February, 1955, did little damage on protected areas. Untreated lands were damaged in many districts.

LOOKING AHEAD

What of the future? Soil conservation on farms in Western Australia is in a fairly sound position, but there are thousands of farm paddocks where evidence of water and wind erosion indicates the need for more protective measures. Improved pastures of subterranean clover, barrel clover, lupins and Wimmera ryegrass are giving

great assistance in improving fertility, and in reducing the proportion of land cultivated each year for cereal crops. Protective cover of living or dead vegetation on the soil surface is the result of more well-managed pasture, less bare fallowed land, and fewer rabbits.

The application of complete soil conservation measures on our farmlands and pastoral areas cannot, at this stage, be rapidly achieved. Many landholders are still not familiar with the more general conservation ideas. Most of those who are, still require much detailed, on the spot, advice about their application. Soil conservation advisory work can go only so far through lectures, leaflets and other forms of the spoken or written word. It is a "farm to farm" job—even a "paddock by paddock" job. It needs trained advisers and technicians who have a sound general knowledge of farming and grazing practices suitable for an area, as well as how to apply special erosion control methods. Our experience so far is that each officer, once he and his work become known, creates a demand for more work than he can reasonably handle. The Soil Conservation Service has always had an unsatisfied demand for advice and visits, some of which have had to be deferred for long periods. I believe efforts should be made to build up the staff till 20 or 25 advisers are available to help farmers with their soil conservation problems, and to carry out the functions and obligations which are set out in the Soil Conservation Act, 1945, and the recent Soil Conservation Act Amendment Act of 1955.

The attitudes and actions of farmers and pastoralists in using their land, will, in the future mainly determine how effective are our soil conservation and erosion control efforts. The general public should encourage them in every way, and support public services which aim to conserve vital natural resources.

RABBIT CONTROL

Outbreaks of myxomatosis continue to be reported from widely-separated areas and some very active spreads have occurred in areas which have not been "seeded" with infected rabbits for 18 months or more.

This suggests that the disease could "smoulder" for long periods and spread rapidly when conditions favoured an increase in the number of vectors such as mosquitoes, stickfast fleas and other insects.

Areas investigated by A.P.B. officers during January-February included Bridgetown, Manjimup, Cranbrook, Albany, Gnowangerup, Lake Grace, Pingrup, Kulin, Kondinin, Hyden and Bruce Rock. Spreads of varying intensity had been reported from all these districts.

At Darkan and Mt. Barker, myxomatosis outbreaks have completely disorganised the "1080" poisoning programmes.

Farmers are urged to take full advantage of the reduction in rabbit numbers by ripping warrens and fumigating to destroy survivors. It was known that a percentage of the rabbits survived the disease and these could build up a resistant strain which would be immune from further outbreaks.

Every effort should be made to wipe out the few remaining rabbits to guard against re-infestation.

BUILD CONTOUR BANKS WITH A DISC PLOUGH

By G. W. SPENCER, B.Sc. (Agric.), and
J. C. GRASBY, B.Sc. (Agric.),
Soil Conservation Advisers

Fig. 1.—Second run, top side. Front discs throwing soil into furrow left by the first or "marker" run. The soil is thrown towards the surveyed line

THE Soil Conservation Service encourages farmers to help themselves with their soil erosion problems. A number have already carried out their own surveys and constructed the recommended earthworks with small machinery. Many others, however, may not be aware of the possibilities of normal farm implements, and in particular, the disc plough.

Often, to reclaim eroded areas and to control water runoff sufficiently to allow the establishment of soil improving pastures, certain earthworks are necessary. Such earthworks need not be regarded as major construction problems as most farms have some equipment which can be used to build contour banks and other structures.

Contour banks are likely to be the most usual earthworks that farmers would attempt to construct. On a number of properties, successful and economical use has been made of large earthmoving machinery such as road graders and bulldozers. Such machinery is not always readily available and so farmers should have a good knowledge of the possible uses of their normal farm equipment.

Among those farmers wishing to carry out their own bank building, the disc plough should be quite popular because it is essentially a one-man machine—an important consideration when labour shortage is such a big factor.

Any type of disc plough, including the more recent large single-disc models should be suitable, provided the machine is in good working order and is fitted, preferably, with large unworn discs. A plough that will not make a good job of ploughing will not build a bank easily and economically. The unworn discs enable efficient moving of soil to form a bank 18in. to 20in. high and with a broad flat channel about 1½ times as wide as the plough. The whole operation can be speeded up if the machine is equipped with hydraulic or mechanical quick-lift to enable more convenient and quicker turning at the ends of the bank. If set machines are used, care should be taken when turning, unless the machine is lifted out of the ground. This is particularly the case at the outlet end of the bank where it is desirable not to disturb the soil below the end of the bank.

Bank building is best done when the soil is in a good ploughing condition. Farmers reducing or eliminating the area of fallow will find that the old fallowing time is particularly suited to earthmoving operations. Even with good soil conditions, the time and number of runs required to construct a bank will vary considerably, due especially to the condition of the plough, the size and speed of the tractor, the general skill and experience of the operator and his understanding of the techniques used.

Fig. 2.—Fourth run, top side. This is the second actual soil moving run and is slightly inside the track of the third run. Tape outlines the growing mound of soil

BUILDING METHOD

Generally the method is to move soil from a wide area on to the line surveyed for the bank. It is a "round and round" system, gradually moving sufficient soil on to a central unploughed strip on which the bank is actually built. Practically all the soil is obtained from the top or channel side of the bank.

First Run, Top Side.

This is essentially a marker run close to, and throwing soil on to, the surveyed line. Speed is not necessary at this stage as the aim is to loosen the soil and to determine whether it is suitable for ploughing. The plough is set reasonably deep as with normal ploughing.

First Run, Lower Side.

Same as run on top side but not as close to the surveyed line, so that an unploughed strip about 2-3ft. wide is left along the line.

Second Run, Top Side.

This is also partly a marker run, being a further normal plough width out from the surveyed line—the front discs throwing soil into the furrow left by the previous run.

Second Run, Lower Side.

This is usually made on the same track as the first run. If, from the previous runs, it appears that it may be difficult to obtain sufficient soil, it is advisable to make this second run about one half a plough width further down the slope.

Third Run, Top Side.

This is actually the first of the soil-moving runs. Compared with the second run, the machine is moved downhill slightly, say about the width of the two discs or the width of the furrow.

At this stage the real aim is to move soil as efficiently as possible. This is best achieved by setting the front discs quite deep and the rear ones just above the previous furrow so that the loose soil only is moved towards the surveyed line and no fresh soil is disturbed. The other important factor is to carry out the operation at the greatest speed that the tractor will permit. This ensures that more soil is moved with each run and can reduce the number of times that the same soil has to be moved.

Third Run, Lower Side.

This is usually on the same track as the first and second runs. If, however, the second run was made wider to obtain extra soil this one should be slightly closer to the surveyed line.

Fourth and Following Runs, Top Side.

The fourth and successive runs on the uphill side are each one furrow width nearer the centre and are intended to move as much soil as possible on to the bank line. At the same time, a broad flat channel of good capacity is formed. To achieve this efficiently, it is most desirable to work at high speed. With each run the tractor and plough are working farther up on the bank. This weight of machines on the growing mound of soil assists in making a well-consolidated bank. After about eight or nine runs a good sized bank should result. If, at this stage, the chan-

Fig. 3.—Sixth run, top side. Shows position of tractor and plough relative to the bank already formed

Fig. 4.—Eighth run, top side. Bank almost complete. Weight of tractor on freshly ploughed soil helps to make a solid bank

nel is not cleared of loose soil, or if the bank is not high enough it may be necessary to make two or three fast runs along the channel and on the slope of the bank.

Fourth and Following Runs, Lower Side.

On the lower side the fourth and successive runs should aim to generally "finish off" this section of the bank. By using this "round and round" procedure the lower side is usually complete first and has a steep slope from the top of the bank to original ground level. If a more gentle slope is desired the last few runs can be made successively a little further down the slope so that the new soil cut by the rear discs is thrown on to the lower part of the bank. This procedure should not be necessary if the working on the lower side was more than the normal plough width at the beginning.

After all available soil from the channel side has been thrown up onto the bank, it should be about 18in to 21in. high with a wide flat channel 6ft. to 8ft. wide depending on the size of the plough. If, at this stage the bank is too small, it is necessary to obtain extra soil by commencing a further series of runs from the outer limits of the previous working.

When using ploughs it is well to keep in mind the following points:—

(1) Move the soil as few times as possible to avoid breaking down the soil structure.

(2) Practically all the soil is most easily obtained from the uphill side.

(3) With each run, attempt to move only as much soil as the machines can handle effectively.

(4) Do not disturb the topsoil from an area any wider than necessary.

(5) Uniform cuts are essential, especially on curves, to ensure a bank of uniform height and a channel of correct grade and uniform capacity.

For best results it is essential that the soil is in a good ploughing condition. This is especially desirable because it has to be moved several times. Soil that is too dry soon becomes very powdery and very difficult to handle.

It has been noticed that a plough-built bank and channel usually has a good grass cover within the first year. This is probably due to the fact that all topsoil is not completely removed. The bank itself contains some subsoil and the channel usually has some topsoil scattered over it. This, with extra fertiliser seems to quickly ensure a grass cover which assists in stabilising the bank and makes a safer channel for carrying large volumes of run-off water. Although soil conservation practices aim to greatly reduce run-off by promoting much better and more even absorption of rainfall, there will be, from time to time, some run-off from much of our farmland. Such run-off is most likely to occur during summer storms or high intensity winter rains when normal conservation farming cannot possibly cope with the large quantities of water. Bank channels should always be protected from damage likely to result from flowing water.

Fig. 5.—Lower side is now complete and tractor is driven almost on top of bank for last two or three runs. Fast working clears the channel of loose soil and throws it up on to the bank

Fig. 6.—Completed bank. Tape outlines total capacity of channel. Note broad flat channel and cross section of bank

When banks are built across minor depressions or filled gullies, "low spots" are likely to occur. There are possible "breakthrough" points which should always be built up, preferably quite a lot higher than the rest of the bank. For this work the soil should always be taken from the lower side of the bank so that the channel is not disturbed any more than necessary. On a number of occasions, damage has occurred to new works when attention has not been given to such weaknesses. In recent years the availability of farm dozers for wheel tractors has made it much easier to build up sufficient soil on these "low spots."

It is expected that banks built with the plough will usually settle slightly. It is also likely that some damage may be caused by stock continuing pads over the banks before the soil has become consolidated. In most cases maintenance and repairs to such damage is not a major problem, as a few fast runs with the tractor and plough along the bank will be sufficient to build it up again. Occasionally, it may be ncessary to obtain extra soil with a farm-dozer, scoop or grader-ditcher; even a small amount of spadework will always be worthwhile. On a number of properties, banks built for six or more years have so far required very little maintenance. Quite often it is considered that later building up is not required, as the erosion hazard is lessened due to the effects of improved pastures and contour working. In the first year or so, however, banks should be carefully inspected and maintenance carried out as soon as necessary.

It can be seen that construction of contour earthworks can be a relatively simple and cheap business when there is no additional expense involved in hiring special machinery. Officers of the Soil Conservation Service can assist farmers by advising on erosion problems; by carrying out surveys for contour earthworks, and by demonstrating the use of farm ploughs as earthmoving implements. After each farmer has been assisted with erosion control work in one or two paddocks it is hoped that he may then find himself able to continue the work, including the surveying, on a self-help basis.

CONTROLLING TOMATO DISEASE

New Hybrids Give Promising Results

This season, the spotted or bronze wilt virus disease was even more widespread than usual, and losses in commercial tomato crops were the worst experienced for several years.

Conditions were therefore very favourable for testing new hybrid lines of tomatoes which are being developed for resistance to this disease by the Plant Pathology Branch of the Department of Agriculture.

In a field test conducted at Balcatta, 80 per cent. of the plants of the local susceptible variety were attacked by spotted wilt, whereas in the hybrid lines the test unit showed only 5 per cent. infection and the worst unit 17 per cent.

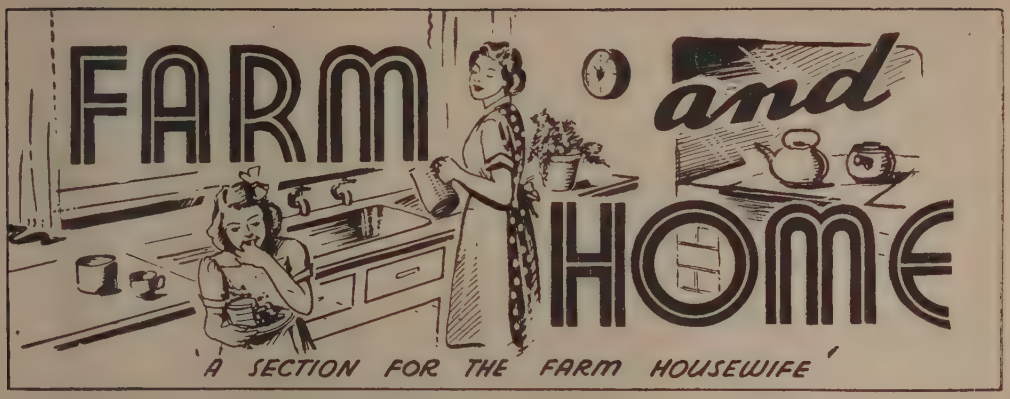
The hybrids derive resistance from two American varieties, Rey de los Tempranos, and Manzana.

INSECT PESTS

Grasshopper outbreaks in various South-West districts caused some concern to growers during January and February. Dieldrin spray is effective against grasshoppers, and where spraying was carried out in accordance with Departmental recommendations effective control was established.

Flea beetles have been troublesome on lawns in the metropolitan area. This insect mainly affects couch lawns but may be controlled by spraying with DDT and other residual insecticides.

Many home gardeners have complained about the activities of leaf-cutting bees which cut neat circles from the leaves of rose bushes and other ornamental plants. Insecticides are of no avail in controlling these insects as they do not eat the leaves but use the material for constructing their nests.



SOME ICE-CREAM RECIPES

By BRENDA CLEEVE

FROM earliest times ice-cream has been regarded as a delicacy to tempt the appetite—especially on searing days when the mercury climbs over the century mark. Romans of Julius Caesar's day enjoyed a type of ice-cream made from snow which was carried from the high mountains by fleet runners and later flavoured with fruit juices. When Marco Polo returned to Venice from the Orient, he brought back a recipe for an ice-cream made from milk and from Italy the popularity of this delectable confection soon spread to other European countries. Charles I of England was so fond of his "Cream Ice" that he granted a special pension to the chef who was responsible for its introduction to his kitchen. Later the name was reversed and so the ice-cream we know today came into being.

Most ice-cream recipes contain some ingredient such as cream, egg, gelatine, cornflour or custard powder to reduce the possibility of ice forming in the mixture. For the same reason ice-cream should be frozen quickly and preferably beaten while being frozen. The second beating which is a feature of many ice-cream recipes breaks up ice crystals already formed and increases the volume.

1. Uncooked Ice-Cream.

1 small tin of cream.
1 cup of fresh milk.
3 tablespoons sugar.
1 teaspoon gelatine.
1 cup boiling water.
Flavouring.

Method—

1. Mix the cream and milk together.
2. Dissolve the gelatine in the boiling water. Add sugar and stir until dissolved.
3. Add dissolved gelatine and sugar to milk mixture with 1 teaspoon of desired flavouring.
4. Pour into tray. When just set, remove from tray and beat until frothy but not liquid. Return to tray and freeze.

2. Uncooked Ice-Cream.

2 cups fresh milk.
4 tablespoons powdered milk.
½ cup sugar.
1 teaspoon gelatine.
½ cup boiling water.
1 teaspoon vanilla.

Method—

1. Beat fresh and powdered milks together.
2. Dissolve gelatine in boiling water. Add sugar and stir until dissolved.

3. Combine all ingredients. Pour into trays.

4. When frozen for about half an inch around edges remove from trays and beat.

5. Return to trays and continue freezing.

(N.B. In this recipe ½ cup sweetened condensed milk may be substituted for ½ cup sugar. It should be beaten with the fresh and powdered milks).

3. Uncooked Ice-Cream.

1 pint milk.
1 egg.
3 tablespoons powdered milk.
1 tablespoon sugar.

Method—

1. Place milk, powdered milk and egg yolk into a basin.

2. Beat egg white until stiff. Add sugar and beat well.

3. Beat milk mixture. Add egg white and beat again.

4. Add flavouring. Pour into tray.

5. Stir every half hour until frozen.

4. Uncooked Ice-Cream.

2 eggs.
2 tablespoons sugar.
1 cup cream.
1 cup milk.
1 teaspoon gelatine.
1 teaspoon vanilla.

Method—

1. Dissolve gelatine in a little hot water.

2. Beat egg whites until stiff. Beat in the sugar and then the egg yolks.

3. Add the cream, milk, dissolved gelatine and vanilla.

4. Pour into trays. When frozen around the edges beat again.

5. Return to trays and freeze completely.

5. Uncooked Ice-Cream.

1 cup cream.
1 cup fresh milk.
1 egg white.
1 teaspoon gelatine.
2 tablespoons sugar.
Flavouring.

Method—

1. Beat egg white until stiff. Add sugar and beat to make a meringue.

2. Dissolve the gelatine in 2-3 tablespoons hot water.

3. Beat the cream. When stiff gradually beat in the milk.

4. Add the meringue, gelatine and flavouring.

5. Pour into trays and freeze.

American Ice-Cream (Cooked).

1 cup milk.
½ cup sugar.
1 tablespoon flour or 3 egg yolks.
1 cup cream.
1 teaspoon vanilla.

Method—

1. Place milk in a saucepan and bring to the boil.

2. Mix the sugar with the flour or egg yolks.

3. Pour the hot milk very carefully on to the sugar mixture, stirring all the time.

4. Return mixture to saucepan and stir over a low heat until it boils. Boil 1-2 minutes if using flour.

5. Allow to cool. Pour into trays and freeze until mixture is set for ½ inch around edges.

6. Beat the semi-frozen mixture until smooth.

7. Beat the cream until just stiff.

8. Fold cream and flavouring into beaten mixture.

9. Pour into trays and freeze.

1. Custard Ice-Cream.

1¾ cups milk.
1 egg yolk.
1 tablespoon cornflour.
2 tablespoons sugar.
Flavouring.

Method—

1. Mix the cornflour until smooth with a little of the milk.

2. Add the beaten egg yolk, sugar, and remainder of the milk.

3. Stir over heat until boiling. Boil 2-3 minutes. Add flavouring.

4. Allow to cool. Pour into trays and freeze.

2. Custard Ice-Cream.

1 pint milk.
3 tablespoons powdered milk.
3 tablespoons sweetened condensed milk.
1 tablespoon custard powder.
2 tablespoons sugar.
2 teaspoons gelatine.
Flavouring.

Method—

1. Mix custard powder to a smooth paste with a little of the milk.

2. Add the remainder of the milk, the condensed and powdered milks and the sugar. Beat to mix in the milk powder.

3. Stir the mixture over a gentle heat until it comes to the boil. Boil 1-2 minutes.

4. Dissolve the gelatine in a little hot water.

5. Add dissolved gelatine and flavouring to the custard mixture.

6. Cool. Pour into trays. Freeze for an hour.

7. Beat well with a rotary beater and return to tray.

Junket Ice-Cream.

2 cups milk.
1 or 2 junket tablets.
1 cup sugar.
1 cup cream.
Flavouring.

Method—

1. Make a junket with the milk and junket tablets.

2. When at the setting stage, beat in the cup of sugar with a rotary beater.

3. Stir in the cream and desired flavouring.

4. Pour into trays and freeze.

If the flavoured junket tablets are used no other flavouring may be required.

Jelly Ice-Cream.

½ packet of jelly crystals.
½ cup sugar.
½ cup hot water.
3 cups milk.

Method—

1. Place the jelly crystals in a pan with the hot water. Heat gently until dissolved. Do not boil.

2. When dissolved add the sugar.

3. To this mixture add the milk and beat together. If liked, a cup of cream may be substituted for one of the cups of milk.

4. Pour into trays and freeze.

5. When the mixture is lightly set, beat up with a fork and then allow to freeze completely.

Quick Ice-Cream.

1 tin of sweetened condensed milk.
The same quantity of fresh milk.
The same quantity of cream.

Method—

1. Combine all these ingredients and beat together.

2. Add desired flavouring.

3. Pour into trays and freeze.

4. Beat or stir the ice-cream twice while it is freezing.

Raspberry Ice-Cream.

1 cup raspberry jam.
2 scant cups milk.
2 tablespoons boiling water.
1 heaped teaspoon gelatine.
1 tablespoon lemon juice.

Small cup cream or chilled unsweetened evaporated milk.

Method—

1. Dissolve the gelatine in the boiling water.

2. Place in a mixing bowl with all the other ingredients and beat until thoroughly mixed.

3. Pour into trays and chill until the mixture is frozen for half an inch around the sides.

4. Beat until light and fluffy but not liquid.

5. Return to trays and continue freezing. Stir well once more before the mixture is completely frozen.

This recipe is delicious if strawberry jam is used instead of raspberry jam. A little red colouring may be added to this ice-cream to improve the colour.

Banana Ice-Cream.

1 egg.

1 cup unsweetened evaporated milk *or* cream.

1 tablespoon honey.

2 tablespoons sugar.

1 dessertspoon lemon juice.

Grated rind of ½ lemon.

2 bananas.

Method—

1. Mash the bananas and add the lemon rind and juice, the honey and egg yolk. Stir in the milk or cream.

2. Freeze until just beginning to set.

3. Beat until light and fluffy.

4. Make a meringue with the stiffly beaten white of the egg and the sugar.

5. Fold this meringue into the beaten banana mixture.

6. Return to trays and freeze. Stir once more before the mixture is completely frozen.

Ice-Cream Variations.

Try these variations with any of the recipes for plain or vanilla ice-creams.

Chocolate.—Add 1 tablespoon cocoa mixed to a smooth cream with a little hot water or milk. This removes the raw taste of the cocoa.

Chocolate Chip.—Add 1 cup of grated or chopped dark chocolate (a semi-sweet variety).

Coffee.—Substitute ½ cup of strong black coffee for ½ cup of milk *or* use black coffee to dissolve the gelatine instead of boiling water.

Fruit.—Add ¾-1 cup of fruit pulp or fruit salad to the mixture in the tray when it is beginning to thicken after being beaten. If tinned fruit is being used, drain off any liquid first.

Fruit-Nut.—After the mixture has been beaten stir in ¾ cup of chopped nuts and crystalised fruits such as cherries, ginger, raisins, walnuts. Add some pink colouring to the mixture.

Choc-mint.—Use peppermint flavouring instead of vanilla, and colour the ice-cream green. When the mixture has been beaten, stir in ½ cup grated chocolate (dark). Taste the mixture when adding the peppermint as some essences of peppermint are very strong.

Ice-Cream Wafers.

2 oz. butter.

2 cups flour.

1 cup sugar.

1 teaspoon bi-carbonate of soda.

½ cup orange juice.

1 tablespoon water.

Method—

1. Beat the butter and sugar together until creamy.

2. Dissolve the bi-carbonate of soda in the water and add to the orange juice.

3. Stir in the flour and orange juice alternatively.

4. Place the mixture in small heaps on a well greased slide and then spread out as thinly as possible.

5. Bake in a moderate oven until a golden brown.

6. As soon as the tray is removed from the oven, cut the mixture into squares or fingers and remove from the tray.

7. When cool, store in an airtight tin.

TAKE CARE OF YOUR BLANKETS

WITH the onset of summer weather, blankets which have been in use in the colder months are being discarded. Proper care of them will keep them in good condition and extend their lifetime. Blankets which are not to be used and are to be stored away should be washed first and then placed in a cool, dry place, protected from moths. They may be wrapped in strong paper or plastic or placed in a lined box. Do not store them with weighty objects on top, or pressed tightly into a case, as they will soon loose their fluffiness. Between washings, blankets should be beaten or brushed to remove loose dust and to keep them soft and fluffy.

To Wash Blankets.

Handle one blanket at a time as the secret in the successful washing of wool lies in the speed and gentleness with which it is accomplished.

If the blanket is very soiled, soak in clear, lukewarm water. Water used for washing and soaking must be soft. Where possible use rain water. If this is not available add about two tablespoons of powdered borax to a tub of water before adding the blanket. Never use washing soda or strong chemicals for softening water as this hardens the wool.

After soaking the blanket, squeeze out the water. Do not use this water for washing. Never twist or rub the blanket during laundering. As with all woollen fabrics, the fibres matt together, giving a harsh surface.

Wash in lukewarm water using just enough soap to make a permanent lather on top of the water. The soap should be dissolved in the water before the blanket is added. If the suds disappear from the water as the blanket is being washed, add some more dissolved soap to the water. Hot water and too much strong soap cause the wool fibres to matt and shrink.

When washing by hand, avoid twisting the blanket, by dipping it up and down in the water until the suds have penetrated every part. Usually two washing waters are necessary—more if the blanket is very soiled.

Rinse in the same manner in two or three tubs of clear warm water. The blanket may be passed through a wringer with a light pressure or squeezed by hand to remove excess moisture. Shake after wringing to raise the nap.

Follow the same principles if using a washing machine. Run the machine for three to five minutes each time for washing and rinsing.

Hang the blanket lengthwise on the line to dry with the weight placed evenly on either side. Straighten the edges and avoid pegs as much as possible. Hang striped blankets so that the stripes run vertically. If the colour does run it will then run with the stripes and not across them. If possible choose a windy day for quick drying. Otherwise avoid intense sunlight as this has the same effect as hot water.

When thoroughly dry, shake and brush the blanket to raise the nap.

APPLE-PACKING CLASSES.

In preparation for the coming apple harvest, the Department of Agriculture, in conjunction with the Manjimup Fruit Growers' Association and Westralian Farmers Co-operative Limited, arranged to hold packing classes at Manjimup.

An excellent response was received from local people and altogether 27 persons attended a three-day course conducted by the Senior Packing Instructor of the Department of Agriculture (Mr. J. S. Bloomfield).

The trainee packers showed keen interest and progressed very satisfactorily. The classes are aimed at teaching the fundamental principles of correct packing and wrapping so that with practice the learner will develop speed and proficiency.

An adequate supply of packers for the Manjimup district is assured for the coming season. A small number of the trainees will enter central packing sheds to supplement the experienced packing staffs, while those who are the sons or daughters of orchardists' staffs, will help to improve the presentation of orchard-packed apples.

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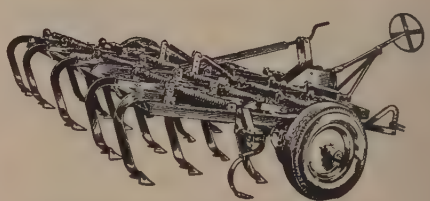

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AUSTRALIAN TRACTOR TESTS

REPORT on TEST No. 24 (Farmers' Edition)

NEW FORDSON MAJOR—DIESEL MODEL

(TESTED FOR THE FORD MOTOR CO. OF AUSTRALIA, GEELONG)

THIS report is taken from the full Technical Report No. 24 of this test; test results are shown here in briefer form; fuller explanations are added. Values quoted here may be rounded out to two instead of three significant figures; to this extent the values quoted may differ slightly but not significantly from those shown in the Technical Report. Graphs of belt test performance, shown in the Technical Report, are not shown here. The Technical Report is not available in large numbers, but may be seen at the offices of the State Departments of Agriculture, the Bureau of Sugar Experiment Stations (Queensland), and the Commonwealth Department of Commerce and Agriculture.

1.—THE TESTS

(1) After 12 hours of running-in, two types of tests were carried out, in order to measure **the performance of the engine,** as measured by the power in the belt driven by the belt pulley, and **the performance of the tractor as a whole,** as measured by drawbar pull, tractor speed, wheel slip,

and drawbar horsepower (d.b.h.p.), with the tractor running on a bitumen test track.

The main results of these tests are given in Sections 2, 3, and 4. Other measurements and observations were made of various features of the tractor; these are given in Section 5.

(2) **Fuel Mixture Settings.**—The engine of this tractor has only one fuel-mixture setting, at which all the tests were carried out.

(3) **Governor Control.**—For maximum loads the throttle was full open; for part loads the governor control was set to give rated speed at the desired loads.

(4) **Fuel.**—Distillate; Cetane No. 58; Specific Gravity 0.836; weight per Imperial gallon 8.36 lb.

(5) **Specification.**—Engine No. 1273851. For a brief specification of this tractor see Section 6 at the end of this report.

2.—SUMMARY OF POWER OUTPUT

Table A.

	At the Belt.	At the Drawbar.
Rated engine speed, r.p.m.	1,600	1,600
Corrected maximum power (*a*)	39·4	36·4
Rated power (*b*)	33·5 (*b*1)	27·3 (*b*2)

Notes.—Letters in brackets refer to explanatory footnotes.

(*a*) Corrected maximum h.p. was calculated by a suitable formula from observed maximum h.p. corrected to 60° F. and 29·92" (sea level) barometric pressure.

(*b*) Engines are not expected to run indefinitely at full or maximum power output. But they can be expected to run continuously for some hours at *rated* output, which is less than maximum, defined as follows :—

(*b*1) Rated b.h.p. is defined as 85 per cent. of corrected maximum b.h.p.

(*b*2) Rated d.b.h.p. is defined as 75 per cent. of corrected maximum d.b.h.p.

3.—BELT TESTS

The belt tests show the power (belt horsepower, b.h.p.) that the tractor may be expected to deliver when driving a machine by the belt.

Belt Test Results.

Table B.

If there is only one fuel setting, no mention will be made of mixture settings in this table.

	B.H.P.	Engine Speed.	Fuel. Gall./hr. (*c*)	Fuel. lb./b.h.p. hr. (*d*)
1. Rated Engine Speed, 1,600 r.p.m.				
2. Fast Idling Speed about 1,730 r.p.m.				
3. Observed maximum b.h.p. at rated speed	38·7	1,601	2·21	0·48
4. Corrected maximum b.h.p. rated speed (*a*)	39·4	Observed maximum value corrected for atmospheric temperature and pressure at time of test.		
5. Calculated rated load (*b*1)	33·5			
6. Test at approximately rated load*	33·3	1,600	1·83	0·46
7. Average loading under governor (*e*)	20	1,630	1·3	0·54
8. Equivalent engine torque at full throttle	127 ft. lb. at maximum power and rated speed 136 ft. lb. (maximum) at 1,100 r.p.m.			

* Governor set to run this test at approximately rated speed.

(*c*) Fuel consumption in gallons/hour may be a simple unit, but it has no meaning unless we also quote the corresponding h.p. output.

(*d*) This is the "specific fuel consumption," the weight of fuel consumed per unit of energy developed by the engine; the unit of energy here is the h.p.-hour, similar to the electrical "unit" the kilowatt-hour. When this figure is least the engine is giving its best economy or efficiency. It is easy to change from column (*c*) to column (*d*) in Table B., *e.g.*, as follows :—

2·21 galls./hr. while developing 38·7 h.p. means 2·21 ÷ 38·7 galls./b.h.p./hr. = 0·057 gall./b.h.p./hr.
0·057 gall./b.h.p./hr. x 8·36 lb./gallon for this fuel = 0·48 lb./b.h.p./hr., as shown in column (*d*).

(*e*) Line 7, Table B., represents the average performance one might expect from the engine while driving a variety of belt loads, from light to heavy. In terms of averate fuel consumption, it means about 1½ gallons an hour.

4.—DRAWBAR TESTS

The following Tables C, D, and E, show the drawbar performance of the tractor, on the bitumen test track, wearing rear tyres 14 x 28, carrying standard weight (1,990 lb. front, 5,630 lb. rear; total 7,620 lb.), working in the gears named in the tables. Height of drawbar 14 inches.

Drawbar tests, using minimum weight of tractor, were carried out, but are not reported here.

If there is only one fuel setting, no mention will be made of mixture settings in these tables.

(1) Maximum Power, Rated (3rd) Gear.

Table C.

	DBHP (*f*).	Pull lb.	Speed m.p.h.	Wheel Slip % (*g*).
1. Rated Engine Speed, 1,600 r.p.m.				
2. Observed maximum d.b.h.p. at rated engine speed	36·4	4,000	3·41	8
3. Corrected maximum d.b.h.p. at rated engine speed (*a*)	36·4	Observed maximum value above, corrected for atmospheric conditions at time of test.		
4. Calculated rated load, (*b2*)	27·3			

(2) Pull at Maximum D.B.H.P.

Table D.

All gears, rated engine speed. See note (*h*).

Gear.	D.B.H.P.	Pull lb.	Speed m.p.h.	Wheel Slip %
1	26	5,570	1·8	20
2	34	4,780	2·6	12
3	36	4,000	3·4	8
4	36	2,660	5·1	4
5	34	1,780	7·2	2
6	29	820	13·3	0½

(*f*) D.B.H.P. is the product of pull (lb.) and speed (m.p.h.) divided by 375.

(*g*) Wheel slip can be measured by noting that, in travelling a given distance, the back wheels make more turns when working under load than when running with no load on the drawbar. The difference in these revolution counts divided by the former count gives the slip as a ratio, which can be written as a percentage (quoted in these tables to the nearest whole number).

(*h*) These are not the maximum pulls available in the gears (*i.e.*, not the maximum sustained pulls), but the pulls at maximum d.b. power, *i.e.*, at full-throttle at rated engine speed.

(3) Various Loads, Rated (3rd) Gear.*

Table E.

Pull. lb.	Speed. m.p.h.	DBHP	Per cent. of Maximum d.b.h.p.	Slip. %	Fuel. Gall./hr.	Fuel. lb./d.b.h.p. hr.
1,510	3·70	15	41	2	1·1	0·63
2,060	3·58	20	54	3	1·3	0·54
2,600	3·55	25	67	4	1·5	0·52
3,160	3·69	31	85	5	2·0	0·54

* Governor set to run these tests at approximately rated engine speed.

(4) Interpretation of Drawbar Tests.

(i) Drawbar tests are carried out on a hard prepared surface. Most field conditions present higher resistance to the tractor's motion, so that, in the field, the maximum drawbar pulls available in any gear will usually be less than those shown in the tables.

(ii) Wheel slip may also be greater in the field; to that extent tractor speeds in miles per hour in the field will be less than those shown in the tables.

(iii) Because of (i) and (ii) above, the drawbar horsepowers available in any gear in the field will usually be less than those shown in the tables.

5.—OTHER OBSERVATIONS

(1) Duration of Test.

Eighty-four hours, including running-in.

(2) Repairs and Adjustments.

(i) When received, it was found that the throttle stop on the intake manifold had been bent during assembly preventing full designed throttle opening. A new intake manifold was fitted. (The Company advises that this defect has been remedied in all subsequent tractors sent from the works.)

(ii) The tachometer supplied with the tractor broke down, possibly due to diesel fuel entering it.

(3) Engine.

Fuel settings—One only.

Heat Controls—radiator, hand-controlled shutter.

Radiator water used—none.

Lubricating oil—type used: S.A.E. 20.

Weight to engine, 15.3 lb.;

Weight from engine after tests, 14.2 lb.

(4) Inspection of Engine and Transmission After Test.

After testing, the tractor was partly dismantled and inspected and found to be in a satisfactory condition.

(5) Tractor Weights (lb.).

——	Front.	Rear.	Total.
*Minimum weight, unballasted	1,990	4,510	6,500
Added weights	....	....	
Water ballast	....	1,120	1,120
†Standard weight, as usually supplied and recommended	1,990	5,630	7,620

* This weight, less driver, was used in finding centre of gravity.

† Weight of tractor in drawbar tests quoted in this report.

(6) Wheels and Tyres.

Tyres.	Front.	Rear.
Type	Rib	Closed centre bar tread
Size	7·50 x 16 x 6 ply	14 x 28 x 6 ply
Pressure	25 psi.	14 psi.

(7) Steering.

With track widths, front 54", rear 60".

Turning circles: Without brakes, 27' L.H., 27½' R.H.; with brakes, 24' L.H., 23½' R.H.

Comment: The tractor was easy to steer with the steering wheel while under load.

(8) Centre of Gravity.

With tractor in minimum weight less driver.—Height above ground, 2' 4". Distance forward of rear axle, 2'.

G. H. VASEY,
Officer in Charge Tractor Testing.

I. T. NAYLOR,
Tractor Testing Officer.
University of Melbourne.

6.—BRIEF SPECIFICATIONS

New Fordson Major Diesel

(Supplied by Manufacturers).

(1) Engine.

No. 1273851. Fordson, England.

4-stroke; 4 cylinders, vertical; crankshaft along tractor.

Bore, 3.937"; stroke, 4.528"; compression ratio, 16 : 1.

Rated speeds: Belt work, 1,600 r.p.m.; drawbar work, 1,600 r.p.m.

Fuel type: Distillate.

Fuel system: Simms pump and injectors; Fuel filters, two replaceable element units. Tank capacity, 15 gallons.

Air cleaner: Oil bath.

Governor: Type—pneumatic.

Electrical system: 12-volt battery and generator.

Starting: Electric, cold start.

Cooling: Water pump and fan, radiator shutters.

Exhaust: "Yuba" type combined muffler and spark arrester.

Lubrication: Oil pump and full-flow filter.

(2) Chassis.

4-wheel; pneumatic.

Wheel base 80".

Track width: Front 54"; rear 60", adjustable.

Tyre sizes: Front 7.50 x 16; rear 14 x 28.

Steering Gear: Recirculatory ball.

Weight: Maximum weight 7,620 lb. (see "Other Observations," section 5).

(3) Belt Pulley.

Standard; right side, clockwise rotation.

Diameter 8½"; face width 6½".

Pulley speeds (at rated engine speed), 890 and 1,600 r.p.m.

Belt speeds (at rated engine speed), 1,980 and 3,560 ft./min., not in accordance with overseas standards (namely 3,100 ± 100 f.p.m.).

(4) Power Take-Off.

Standard; guarded; location, centre rear.

Speed: 723 r.p.m., not in accordance with overseas standards (namely, 536 ± 10 r.p.m.).

Dimensions: 6 spline, 1⅜" diameter.

(5) Drawbar—Swinging.

Height as tested, 14", adjustable.

(6) Transmission—Conventional Gears.

Clutch: Type, single dry plate; size, 11"; pedal control.

Gear ratios and road speeds (assuming no wheel slip) on 11.00 x 36 tyres, at rated engine speed, as advertised:—

Gear.	Forward.						Reverse.	
	1.	2.	3.	4.	5.	6.	Low.	High.
Ratio	123	87·3	68·4	48·6	34·8	19·3	91·1	50·7
Speed, m.p.h.	2·1	2·9	3·7	5·2	7·3	13·2	2·8	5·0

(7) Hydraulics.
Optional, not fitted.

(8) Three-Point Linkage.
Optional, not fitted.

The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement, the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: C/o. Department of Commerce and Agriculture, 301 Flinders Lane, Melbourne.

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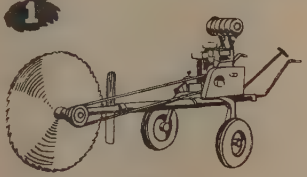

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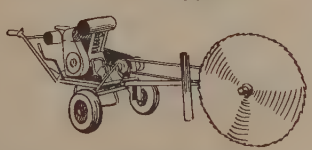

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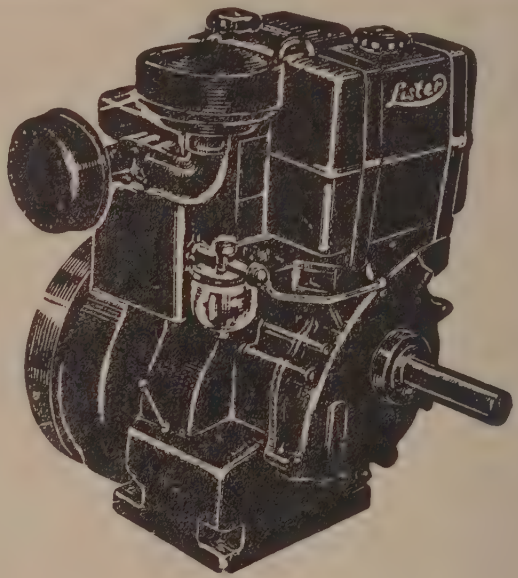

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CATTLE CORNER

By K. NEEDHAM, B.Sc. (Agric)
Dairy Cattle Husbandry Officer.

COSY CALVES

The calving season is here again—or just around the corner. These calves are a "headache" to most dairy farmers but as the heifers play a part in building up

the herd it is profitable to keep them comfortable. Calf troubles like the poor are always with us, but many of them can be avoided by following a few simple rules. May I suggest that you think about them now and be prepared rather than to wait for trouble to arrive.

Firstly keep the in-calf cows handy so that if calving trouble develops it becomes obvious in time for you to render assistance. Try to arrange that the calf receives colostrum for at least the first 24 hours but preferably for three days. See to it that you can then give it skim milk in clean buckets in clean dry surroundings. Calves will respond to access to grazing and at an early stage of their career they relish a nibble at good hay and a little crushed cereal grain.

For those of you in the whole milk business to whom calf rearing may present many obstacles I suggest you consider such substitutes as powdered skim milk, buttermilk, meatmeal, whalemeal, or whale solubles. Your first reaction may be that this is unprofitable but a good heifer from a good cow by a good bull is always profitable. Finally give them shelter and try to have at least three calf paddocks available which can be rotated at weekly intervals. This will go a long way towards beating the worm menace.

OATS FOR EARLY GRAZING

With the feed getting scarce and the silage reserves exhausted you may still feel that the time is not yet ripe to start feeding hay. Nevertheless this is the time to be thinking about the provision of that all-important early green bite for the milkers. If your calving dates have been arranged correctly—or alternatively you have been lucky at stocking time—your cows in the butterfat areas will be "coming in" during March, April and May.

It is important—and a good money-spinner—to provide a crop for early grazing. You have heard, and so have I, that if you bring a cow in at a good production level you have a chance to maintain it but if she is low at the start it is difficult to raise her production. One way to ensure a good start is to provide adequate supplies of green oats early in the season.

Many farmers who provide early green feed find that it seems to disappear equally early. I suggest for your consideration that you should not necessarily plant a dual-purpose crop—for both hay

and grazing. It would be a good practice to provide some early grazing from your cereal hay paddocks but in addition set aside a definite area which can be grazed without fear of affecting your hay estimates.

Think along the lines of sowing early—in the "dry"—and fairly heavily—say two bushels to the acre. As for a suitable variety I suggest you try Wongan.

Finally, try strip grazing it with the electric fence. You will be very agreeably surprised by the results.

CALF MARKING

The New Year for Grade Herd Recording started on March 1—here is a New Year resolution—mark your calves. Presuming that you are practising good cattle husbandry methods then you will be in a Grade Herd Recording Unit and to obtain the maximum benefits from this scheme you should be marking your heifer calves for future identification—but unfortunately my information indicates that only a few farmers do this.

If you are culling according to production—whether on wholemilk or butterfat —you will need replacements. Calves with a tattoo in the ear have a legitimate place in any herd and when it comes to the selection of replacements guesswork is eliminated.

Now that an Artificial Breeding Scheme is in operation it is even more important to identify the heifer calves and furthermore it will help us with Sire Surveys and progeny testing schemes.

These comments apply also to persons whose herds are not under test because you also no doubt will be following a programme of grading-up. The procedure is not difficult and can be applied successfully, earmarking the animals with light-coloured ears. Other breeds will need a firebrand or ear-punch system. If you are

in a Grade Herd Recording Unit your recorder will be happy to assist with marking at each visit. With his help the task will be lightened considerably. So make sure it is done regularly.

MOLYBDENUM FOR ROCKMELONS.

A striking improvement in the growth of rockmelons has been obtained by a Dardanup grower as a result of using a small quantity of molybdenum as a fertiliser. Plants which were not treated have remained stunted and yellow, and the edges of the leaves have withered.

The molybdenum was used following a suggestion by a departmental officer (Mr. H. K. Gibsone), that it be tried as a means of overcoming unsatisfactory growth.

A molybdenum deficiency of rockmelons has not been previously recorded in this State, and it is believed that in view of the remarkable response obtained, this observation may be of considerable value to growers in the South-West.

The Director of Agriculture (Mr. G. K. Baron Hay), emphasises that at this stage no general recommendation for the use of molybdenum fertiliser for this crop is made, but suggests that when rockmelon plants remain unthrifty for no apparent reason, growers might well approach the local agricultural adviser with a view to arranging a suitable trial with molybdenum.

RABBIT CONTROL

Reports from country areas indicate that many farmers are not taking advantage of the widespread outbreaks of myxomatosis which have occurred recently. Even though the rabbit population may be greatly reduced, every effort should be made to deal with the survivors by poisoning and warren ripping.

It has been shown fairly clearly in the Eastern States that the residual population will contain a percentage of resistant and recovered rabbits. If these are destroyed, the eventual build-up in resistance to myxomatosis will be greatly retarded. Even if no rabbits appear to be present, all warrens should be destroyed to prevent re-colonising.

The spreads of myxomatosis extend along the southern coast from Esperance to Manjimup and north to Northampton. They cover most of the agricultural areas and there are few districts from which reports have not been received. The outbreaks are not spectacular, and there are big gaps between them. However, thousands of rabbits are being killed. Spreads are typical following the exceptional winter experienced.

MANAGEMENT AND DISEASES OF CAGE BIRDS

By P. M. A. HARWOOD, M.R.C.V.S., Senior Veterinary Officer

CAGE birds are often expected to live out their life span and reproduce their kind in surroundings very unlike those which appertain in nature. As a result of these factors the birds are very liable to disease both caused by malnutrition and also by a build-up of organisms due to overcrowding and bad hygiene.

The common cage birds fall into two main groups, the passerines including canaries and finches, and the psittacines including budgerigars, parrots, lorikeets and cockatoos. Most of these birds are seed-eaters and the digestive processes are similar.

Before dealing with the individual types of birds let us consider the general processes of digestion in seed-eating birds. The beak is adapted to remove the hard husk of the seed. The de-husked kernel is swallowed and passes into the crop. The crop is normally filled twice daily, in the morning and the evening.

From the crop, seed passes into the proventriculus where it is subjected to the actions of the digestive juices and thence to the gizzard. The gizzard is a very muscular organ with a hard horny lining and should contain pieces of sharp grit. In this organ, the seeds are ground up and pass into the intestines where the nutritive components are absorbed.

In the cloaca the droppings are formed from the waste products of digestion added to which are the wastes from the kidneys. The normal droppings of the seed-eating bird are quite firm, and black in colour with flecks of white on the sur-

face. Any looseness, wateriness or brown or green colouration is abnormal, as is a very dry powdery dropping.

MANAGEMENT AND DISEASES OF CANARIES

The canary is a bird of the finch type which by a process of selection has reached a state of domestication. Many types and varieties have been evolved and it is not proposed to discuss points of the various breeds of canaries in this article.

Canaries may be kept in cages or small aviaries but do not breed very successfully in communities. For successful breeding the following methods are adopted:—

Wire-fronted breeding cages 12in. high by 12in. wide by 24in. long are used. A removable wire partition divides each cage into two compartments.

Male canaries commence quarrelling as soon as they approach maturity and must be kept individually.

Females will live together in communities and are usually brought into the breeding cages three to four weeks before the commencement of breeding operations in September or October.

The male is placed in one compartment; the female in the other. After several days, when he is seen to be "displaying" to the female, the division is removed, care being taken to watch that he is not markedly aggressive.

Nests may be constructed of round polish tins hung in the upper half of the cage. Strips of hessian, pieces of cotton wool and dry grass are provided as nesting materials.

Incubation takes 13 to 14 days and is carried out by the hen during which time she is fed by the cock. Both parents feed the young birds which are independent 36 days after hatching.

At this stage the young birds should be removed and put into a large flight cage or aviary until March or April when it is advisable to separate the males.

Sexing.

Although the determination of sex in canaries is largely a matter of experience, the following points may help the beginner:—

The male has a stronger, more thickset and "masculine" head. He is usually a little larger and more heavily built. In the male the vent is "proud"—that is it protrudes slightly from the underline.

Feeding.

For the maintenance of canaries throughout the year the following seed mixture is very suitable:—

Plain canary seed—7 parts (by measure).

Rape seed—1 part (by measure).

Hulled oats—1 part (by measure).

White millet—$\frac{3}{4}$ parts (by measure).

Linseed—$\frac{1}{4}$ part (by measure).

In addition small quantities of fresh greenstuff such as lettuce and thistles should be offered daily. Any stale or wilted greens should be removed at once. Cuttlefish bone should be available at all times as should some sharp grit such as coarse river sand.

Breeding canaries require special feeding. To the usual seed mixture a little panicum seed should be added with a small quantity of niger seed twice weekly. Egg food composed of a crumbly mixture of milk arrowroot biscuits and hard-boiled egg yolks must be given while the young birds are being reared. This food is invaluable to bring the birds into top condition just prior to mating.

Diseases of Canaries.

1. *Redmite*—This pest is associated with dirty cages. The mites harbour in cracks and crevices during the day time coming out at night to suck blood from the birds. They cause weakness, anaemia and sometimes death and frequently cause sitting canaries to leave their eggs. The cure is to thoroughly clean and disinfect the cages and to avoid introduction of the pest in cages, travelling boxes, show cages, etc. A most effective remedy is to immerse the cages in boiling water. The surrounding areas should be painted with creosote or

sprayed with an effective insecticide such as Dieldrin or Chlordane after all cages and birds have been removed.

2. *Paratyphoid*—Losses are quite common particularly in young stock due to infection with organisms of the salmonella group. Birds are usually found dead and the disease may assume epidemic proportions. Scrupulous attention to the cleanliness of the drinking and feeding vessels is an important factor in control but attacks may follow a lowering of the bird's resistance due to chills, draughty cages, unfavourable weather etc. If an outbreak occurs, cages should be thoroughly cleaned and disinfected and a 0.2 per cent solution of sulphamezathine (a drug frequently used by the poultry industry) given in place of drinking water for four to five days. Earthenware, china or glass drinking vessels must be used.

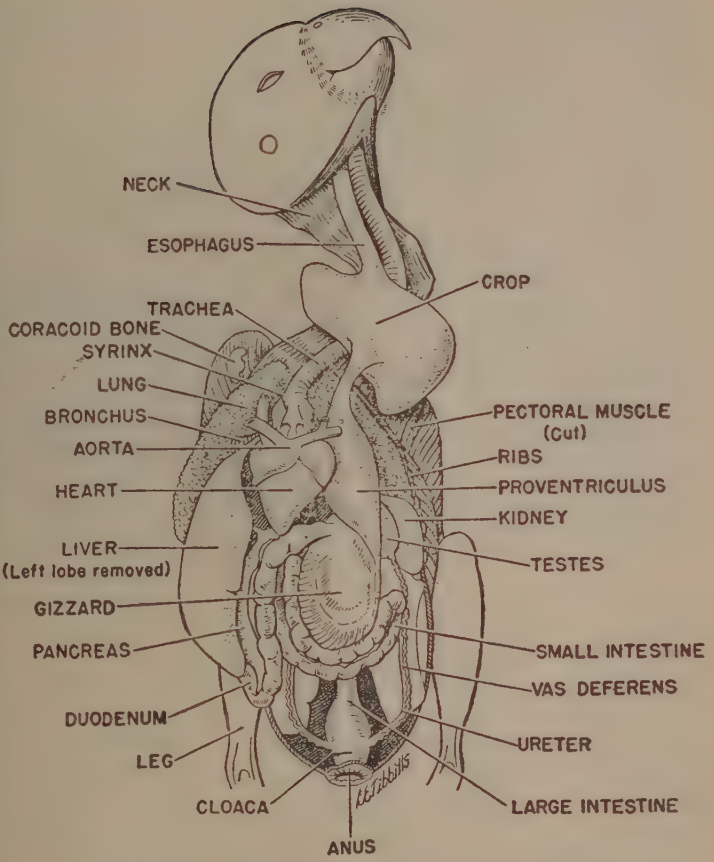

Diagram of the viscera of a typical parrot, ventral aspect.

N.B.—Sulphamezathine is usually sold as a 16 per cent. solution, a 33⅓ per cent. solution, or in half-gram tablets. To make an 0.2 per cent. solution, add 8 drops of 16 per cent. or 4 drops of 33⅓ per cent. solution to 1 fluid ounce of water. Alternatively, dissolve one half-gram tablet in 8 fluid ounces of water. (There are 20 fluid ounces in a pint and a medicinal tablespoonful is half a fluid ounce.)

3. *Egg-binding*—Usually occurs during cold weather or in immature badly-conditioned stock. Symptoms are that the hen canary which has previously been going about the business of nesting is found sitting fluffed up in the corner of the cage. One or more eggs may have been laid before egg-binding occurs. It is due to spasm of the oviduct. The following treatments are recommended:—

(a) The bird is put in a small box with a fly wire bottom which is covered with flannel, the box is gently steamed from a kettle and placed in a warm place (80-90°F). This treatment usually relieves the condition promptly and the hen may be returned to the breeding cage as soon as the egg is laid.

(b) Two drops of warm paraffin oil are placed in the vent and a further two drops given by mouth. Heat is also advisable.

4. *Scaly Leg*—Scaly leg is due to a mite of the genus *Cnemidocoptes*. Symptoms are that the scales on the leg are rough

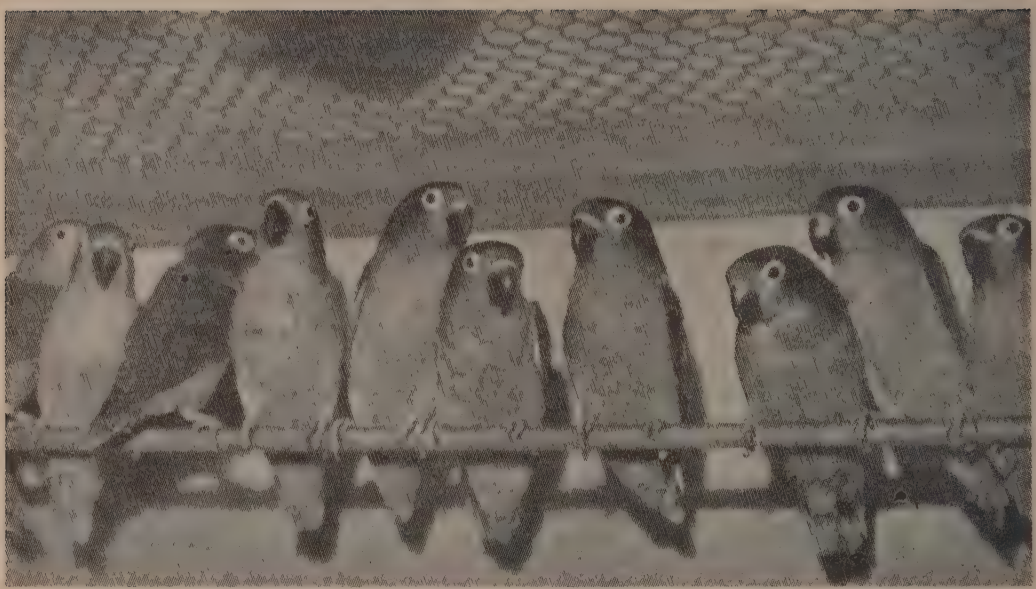

Fig. 2.—A group of African lovebirds.

and raised and have a powdery appearance. Cure is effected by painting the legs at three-day intervals with olive oil.

General Points in Canary Management.

1. Perches should be of good sized dowel (½-inch or more). In the aviaries, branches will provide the necessary toe exercise for young birds in addition to dowel perches.

2. All birds hate wet and draughts.

3. Water and food dishes must be placed so they do not become contaminated with droppings. If automatic feeders are used, husks must be blown off regularly; with open dishes feed little and often, keep the husks blown off and always discard stale, wet or contaminated seed.

4. The cleaner the birds are kept the better will be the results.

5. Avoid redmite by constant vigilance and by a rigid quarantining of new birds. Disinfect all nests and cages after the breeding season.

MANAGEMENT AND DISEASES OF FINCHES

Finches are small seed-eating birds many of which are native to tropical Northern Australia.

To thrive, they require protection from cold, wet and draughts. Finches agree well with each other and probably do best in groups in planted aviaries in well-sheltered positions. A very suitable type of aviary for finches is one with solid walls on three sides, roofed over three-quarters of the way, with the open front facing north. Evergreen non-poisonous shrubs with close foliage such as ti-tree, lucerne tree, dwarf cyprus etc., should be planted in the open part to encourage insect life. The nests should be put under the covered roof—finches breed after, and not during, the rains and wet nests are fatal to the young. Good finch nests are made from cylinders of cardboard about 4in. in diameter suspended at an angle of 30°. Dry grass, hessian and cotton wool should be provided for nesting materials.

Feeding of Finches.

The basic seed mixture for feeding finches is—

Panicum seed—7½ parts (by measure).

Plain canary seed—1½ parts (by measure).

White millet—1 part (by measure).

Fig. 3.—Budgerigars.

Larger finches also require a small amount of hulled oats. In addition, greenstuff and flowering grasses should be given with cuttle fish bone and plenty of gritty sand available.

With many finches good breeding results can be obtained only when a certain amount of live insect food is given. In a large well-planted aviary the birds may find most of this for themselves but nearly all finches relish white ants when rearing young.

Both sexes of most finches share incubation and feeding of the young. Young finches are plain-coloured when they leave the nests, attaining the coloured plumage a few weeks after they are independent of their parents.

Sexing.

Many species of finches are commonly kept in captivity. It is not intended to deal here with the individual types. In most species the sexes are coloured differently and all finches can be sexed readily by an experienced breeder.

Diseases of Finches.

1. *Redmite*—This is a most serious pest when it gains entry to an aviary. To guard against it, destroy all old nests by burning and adopt strict quarantine measures with new introductions.

2. *Paratyphoid*—Causes sudden deaths, usually associated with overcrowding and bad hygiene. To control keep water and seed scrupulously clean and remove the surface sand and replace with clean sand each year. If an outbreak occurs give 0.2 per cent. sulphamezathine solution in the drinking water.

3. *Enteritis*—Follows the feeding of stale or unsuitable green stuff. Many common garden plants are poisonous to finches—violets, jonquils, gladioli, etc. Remove the cause and give fresh boiled water daily. Symptoms are watery, greenish droppings and soiled vent feathers.

4. *Chills*—Deaths often follow spells of cold wet weather in an unprotected aviary. Careful selection of the site of the aviary will prevent losses from this cause.

MANAGEMENT AND DISEASES OF BUDGERIGARS

Budgerigars are small birds of the parrot family. They live naturally in flocks and do well and make the best display when kept in communities. Any aviary which gives protection from unfavourable weather and cold winds will suit budgerigars, and single birds if properly cared for in cages live for years and often learn to talk. An almost infinite range of colour variations exists.

Budgerigars breed in wooden nest-boxes 6in high by 6in. wide by 9in. deep. The floor should be slightly hollow and the eggs are laid on the bare wood. The entrance hole should be 1½in. in diameter and near the top of the front of the box. A small perch is fixed just below the entrance. Always provide twice as many nest boxes as there are pairs of budgerigars in the aviary. The hen incubates the eggs being fed by the cock, both birds feed the young.

Note.—In spite of the common term "lovebird," budgerigars tend to be rather

promiscuous. When breeding for a particular colour variety the pairs must be kept separately.

Sexing.

Budgerigars are sexed according to the colour of the cere which is the bare area of skin just above the beak. This is a rich blue in the male and chocolate brown in breeding females. In young females the cere is a pale watery blue. Young birds just out of the nest do not vary much in the colour of the cere—when handled males bite gently or not at all, females bite hard and hang on. Budgerigars reach sexual maturity at an early age.

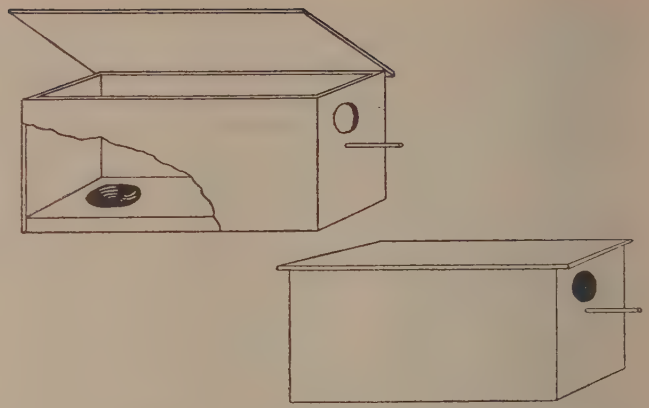

Fig. 4.—A good type of budgerigar nest-box.

Feeding Budgerigars.

A good seed mixture for budgerigars is:—

White millet—6 parts (by measure).
Plain canary seed—2 parts (by measure).
Panicum seed—1 part (by measure).
Hulled oats—1 part (by measure).

Greenstuff and flowering grass should be given at all times and in quantity when the birds are breeding. Budgerigars require large quantities of cuttlefish bone, plenty of sharp grit, and benefit from a box of loamy soil of which they will eat a good deal. When breeding, a quantity of hulled oats may be increased up to one quarter of the total mixture.

Diseases of Budgerigars.

1. *Redmite*—As with all small birds, redmite is easily the worst pest affecting budgerigars. Particular attention must be paid to the nest-boxes and these should be removed and dipped in boiling water regularly. Strict quarantine and general cleanliness are important.

2. *Enteritis*—Due to soiled green feed or contaminated water. Symptoms are diarrhoea and soiled vent feathers. Scrupulous cleanliness, removal of the cause and freshly boiled drinking water are the remedies.

3. *Paratyphoid*—Usually causes sudden deaths. Use 0.2 per cent. sulphamezathine in the water and attend to hygiene.

4. *Egg-binding*—This is similar to the condition described in canaries and is treated in the same way. Egg-bound hens may remain in the nest-box and will soon die if not promptly detected.

5. *Coccidiosis*—Associated with damp, dirty, overcrowded conditions. Symptoms are of listlessness, ruffled feathers and blood-stained droppings. Treat with 0.2 per cent. sulphamezathine solution. Clean dry floors to the aviary will prevent the condition.

6. *French moult*—This condition is seen principally in fledglings. The primary flight feathers and tail feathers do not develop normally but are stunted and deformed and continually moulted without being replaced by normal feathers. The body has normal feathering. French moult is usually seen in budgerigars kept on the colony system and allowed to breed unchecked. It is definitely associated with degenerate stock and overcrowding and redmite may also be a contributory cause. As the feather follicles are affected beyond repair, there is no cure for the condition. Affected birds (crawlers) should be destroyed, all nest-boxes should be removed for three months and disinfected before re-introduction. The stocking of the aviary should be reduced.

7. *Vitamin A deficiency*—Usual symptoms are of paralysis of the legs. The bird may be able to fly normally but cannot

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Ridgecap, Gutter, Downpipe, solder, S.H. Nails	10 13 4	14 5 7	11 14 1
Cement for foundations	(8 bags) 5 4 0	(10 bags) 6 10 0	(8 bags) 5 4 0
G.C. Iron for roof and gables (Australian)	48 3 1	61 18 3	73 4 0
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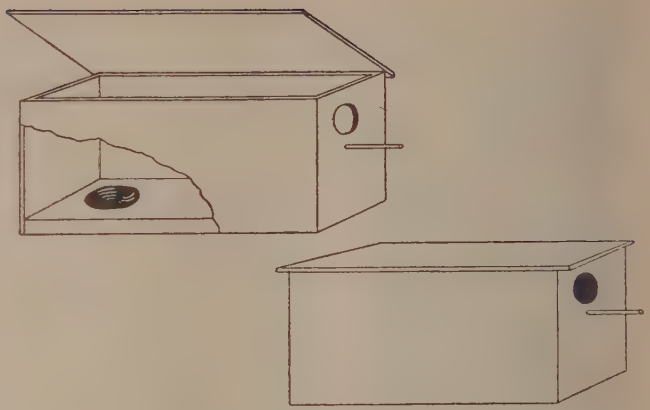

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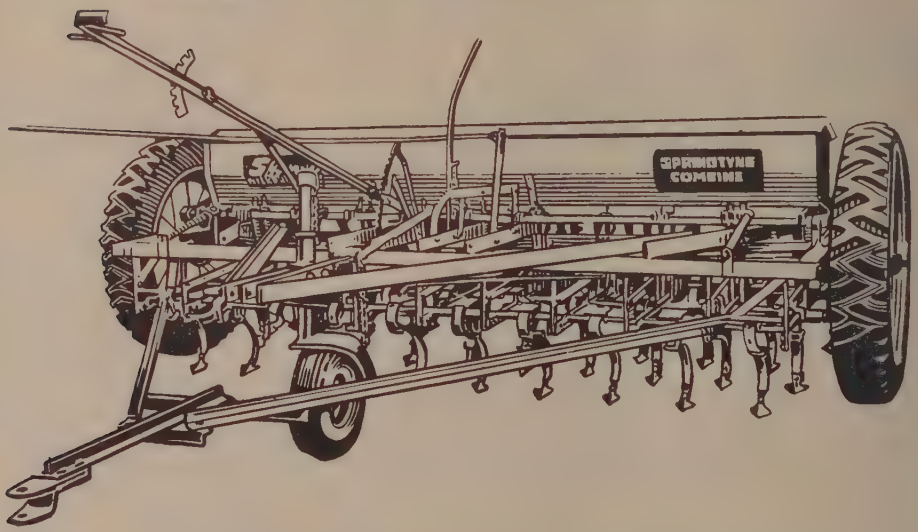

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Fig. 5.—Sulphur-crested cockatoo.

perch. Vitamin A is present in greenstuff which is the best source. An alternative source is shark liver oil such as Vetemul which is given in the feed or the water.

MANAGEMENT AND DISEASES OF COCKATOOS

Birds of the cockatoo family—galahs, Major Mitchells, corellas and sulphur-crested cockatoos are kept as pets, male birds particularly being in demand as talkers. They are usually kept in wire parrot cages or at partial liberty with a cut wing.

Handling Cockatoos.

Hold the bird with the thumb close under the lower bill and the fingers around the back of the neck. Leather gloves are advisable.

Cutting Wings.

To prevent cockatoos from flying, cut the long primary flight feathers with scissors, on one wing only, close to the rear edge of the wing. Remember these feathers are replaced at each annual moult usually in mid-summer.

Excessive Screaming.

This unfortunate habit is very prevalent in birds of the cockatoo family and is mainly due to boredom. Handle the bird frequently to make it tame, cut its wing and let it out of the cage to walk around as much as possible. Give it branches or pieces of soft wood to chew up in the cage.

N.B.—All cockatoos scream towards evening.

Feather Plucking.

This habit is due partly to boredom and partly to incorrect feeding. Let the bird out of the cage frequently, give branches to chew and put a piece of fresh turf in the cage. This will provide the bird with some occupation and will also supply valuable minerals. Make sure the diet is adequate.

Teaching to Talk.

Young birds taken from the nest and reared by hand make the best talkers. Repeat the phrase to the bird very frequently, particularly after it has been fed and is restful. Do not cover the cage. Paradoxically hens show little talent as talkers. Splitting the tongue is a cruel practice and has no value whatsoever.

Hand Rearing.

The best stage to start hand rearing cockatoos is when the body is fully feathered and the tail feathers are just starting to grow. Feed on a mixture of "Farex" infant food moistened with watered milk with a few drops of shark liver oil added. The mixture is fed twice a day with a spoon at first—later the bird will pick up the food for itself. When the tail feathers are fully grown start to feed with soaked, crushed wheat and hulled oats for a few days before giving dry seed. If oatmeal is used in place of Farex as a rearing food add ground cuttlefish bone as a source of calcium, or rickets will occur.

Feeding Cockatoos.

The following seed mixture should be used:—

Sunflower seed—6 parts (by measure).
Whole oats—2 parts (by measure).
Whole wheat—1 part (by measure),
Yellow maize—1 part (by measure).

Peanuts may be given occassionally, but sunflower seeds are much preferred. Make sure the other grains are being eaten before replenishing the supply. Greenstuff, cuttlefish bone and grit are essential and a certain amount of fresh fruit and soaked bread tend to prevent feather plucking.

Sexing Cockatoos.

In males of the galah, Major Mitchell and sulphur-crested species, the iris of the eyes is dark brown or black—in females it is light brown or orange. This difference does not occur in fledglings. Male corellas are noticeably larger and more robustly built than females.

Diseases of Cockatoos.

1. *Pneumonia*—The most frequent cause of death in cockatoos especially galahs. Symptoms are that the bird appears ill with ruffled feathers and vomits a mucoid substance which adheres to the feathers of the breast. Affected birds are often excessively thirsty. Pneumonia frequently follows wetting. In wild birds the feathers are coated with a water repellant oil which prevents wetting of the skin. On an artificial diet this substance is often not present. Treatment is very difficult as most drugs given by mouth are vomited. Extreme warmth (80 to 90°F) day and night is helpful, with complete protection from draughts. Very small quantities of 0.2 per cent. of sulphamezathine given frequently may be retained long enough to be of value. Valuable birds may sometimes be saved by the injection into the breast muscle of 5 mgms. of aureomycin. This treatment must be carried out by a veterinary surgeon.

2. *Enteritis*—This condition is due to incorrect feeding or dirty conditions. Symptoms are of illness with ruffled feathers, green or brownish diarrhoea and soiling of the vent feathers, complete loss of appetite and increased thirst. To treat, give warmth and protection from draughts and give up to 1 teaspoonful of fluid magnesia daily. Remove the seeds and offer freshly-soaked bread. Limit water consumption until droppings are normal. Return to full ration of seed slowly.

3. *Overgrown Beaks*—A cockatoo's beak grows rapidly and constantly throughout its life. Unless it is being worn away by chewing, the beak becomes overgrown and distorted and interferes with the birds ability to feed. In mild cases give pieces of hardwood, mortar or bones to chew. In severe cases trim back to shape with nail clippers.

CARE AND MANAGEMENT OF PARROTS

Parrots are kept either for purposes of display in aviaries, or singly in cages as

Fig. 6.—Galah nestlings.

Fig. 7.—Western rosella.

talkers or whistlers. The majority of native parrots are quite unsuited to life in a small cage—a certain amount of flying exercise is essential to health.

All parrots tend to be quarrelsome when kept together. They should either be kept in individual pairs or in large aviaries with plenty of perches and feeding stations to avoid bullying. Successful breeding will only take place where parrots are kept in individual pairs.

Feeding of Parrots.

The following seed mixture is suited for the needs of the majority of parrots:—

Sunflower seed—5 parts (by measure).
Oats—3 parts (by measure).
Plain canary seed—1 part (by measure).
Panicum seed—½ part (by measure).
White millet—½ part (by measure).

Whole oats are suitable for the larger parrot but the smaller types require hulled oats. For grass parrots use this mixture:—

Plain canary seed—5 parts (by measure).
White millet—2 parts (by measure).
Panicum seed—1 part (by measure).
Hulled oats—1 part (by measure).
Sunflower seed—1 part (by measure).

In addition, greenstuff must be given with plenty of fresh fruit (apples are very good) and leafy twigs to chew. Cuttlefish bone and sharp grit are essential to parrots.

Diseases of Parrots.

1. *Psittacosis*—This condtion is usually seen in parrots that are newly acquired and have not yet settled down. It is very unusual to encounter the disease in parrots that have been bred in aviaries or which have been kept in captivity for any length of time. Symptoms—the bird sits ruffled up with its head "tucked under its wing" and takes little notice when approached. The eyes are partly closed and the feathers stand up on the back of the head. The vent may be soiled. When the bird is taken in the hand the breast muscles will be found to have wasted away and the breastbone feels sharp and bare of flesh.

Psittacosis has been found in most types of birds in addition to parrots and is capable of affecting humans. Any bird, suspected of being diseased should be destroyed and burned immediately and the cage thoroughly disinfected. It may be mentioned here that contrary to findings overseas there have not been many human cases of the disease in Australia and apparently only one human death has been reported. In view of the large extent to which parrots are kept in this country one must conclude that the risk of humans becoming infected from birds is not very great here. Quarantine regulations prevent the importation of parrots (and other birds) from overseas and this measure has probably prevented the deadly form of the disease from becoming established in Australia.

2. *Injuries*—Untamed parrots are very timid creatures and are very apt to bang their heads when startled. Many deaths occur from this cause, the injury usually being to the skull just above the beak.

3. *Pneumonia*—Vomiting of mucus is the most frequent symptom. Treatment is warmth and small quantities of 0.2 sulphamezathine solution.

4. *Enteritis and Paratyphoid*—In parrots enteritis may be due to incorrect feeding, feeding spoiled greenstuff or due to infection of organisms of the salmonella group, this latter form is highly infectious. Symptoms are of copious green or brown watery diarrhoea, listlessness, ruffled feathers, loss of appetite and excessive thirst. Remove the cause and give boiled water to which is added 1 teaspoonful to the ounce of fluid magnesia. If paratyphoid is suspected give 0.2 per cent. sulphamezathine in the drinking water. Strict hygiene is the best preventative.

MANAGEMENT OF LORIKEETS

Lorikeets are birds of the parrot family which naturally feed on the nectar of native blossoms and native fruits. The best known member of the group is the Blue Mountain lorikeet or parrot.

Being specialised feeders they do not take kindly to a diet of bird seed. To thrive, lorikeets should be fed on Farex infant food or milk arrowroot biscuits well wetted with the following solution—

1 part of honey, 1 part new milk, 2 parts water (warm and blend together).

Feed in glass or china dishes and give fresh, daily in winter, twice daily in summer. In addition fresh fruit should be fed *ad lib.* and greenstuff must be given.

The droppings of lorikeets are normally very fluid. If kept in a cage, dry sawdust should be used on the floor. Lorikeets are subject to the same diseases as parrots. They are very susceptible to enteritis if the food is left to sour.

OTHER CAGE BIRDS

1. Quail.

Quail are kept in mixed collections of birds. They feed off the ground and collect spilt seed. Quail are related to the common fowl. They should be fed on white millet, plain canary seed and panicum seed and are fond of insects. They must be fed on the ground. Young quail are susceptible to blackhead and should be reared on clean ground. Baby quail easily pass through half inch netting. Insects (especially meal worms), are essential to rear quail. Dust baths should be provided.

2. Doves.

Doves are usually kept in mixed displays of birds. They agree well with birds of all kind but may quarrel among themselves. They are fed on 8 parts white millet, 1 part panicum seed and 1 part hulled oats. Plenty of sharp grit is essential. Doves breed quite readily in captivity building a nest of twigs on top of some level surface. Platforms edged with beading are best. Put twice as many platforms as there are pairs of doves. When rearing young, doves produce a secretion from the crop known as pigeon milk. Doves are susceptible to build-up of parasites and disease-causing germs in stale ground and require clean fresh sand floors.

GENERAL HINTS ON AVIARY MANAGEMENT AND CONSTRUCTION

1. Construction.

(a) Build the aviary so that it is large enough to allow the birds plenty of exercise (1 cu. ft. minimum per bird of finch size).

(b) Protect the birds from unfavourable weather and winds and allow access to sunlight. Most favourable exposures are east to north.

(c) Avoid projecting surfaces where droppings accumulate.

(d) Doors should open outwards.

(e) Arrange perches so birds roost under shelter.

2. General Management.

(a) Avoid overcrowding. A few healthy active birds make a better display than a lot of dull, dispirited ones.

(b) Remove and isolate sick birds immediately. It gives them a better chance of recovery and reduces the spread of infectious diseases.

(c) The cleaner the aviary the healthier and happier the birds.

(d) Greenstuff keeps fresher if the stalks are placed in a jar of water.

(e) Cuttlefish bone should be wired to the netting at the end of a perch. It will keep clean and last longer.

(f) Mice can be controlled only by (1) keeping split seed off the ground (2) hanging seed containers from wires (3) constant use of a rodenticide containing Dicoumarin which is relatively harmless to birds. This should be placed under a box which is raised ¼in. on one corner. Mice pass easily through half inch netting.

NOTE.—The keeping of birds is subject to several regulations and it is advisable to be aware of these.

A large proportion of the native birds are protected and it is an offence to keep them in captivity. In addition several birds are declared vermin and the keeping of these is also prohibited. Check with the Chief Warden of Fauna and Chief Vermin Control Officer to ensure that you do not break the regulations.

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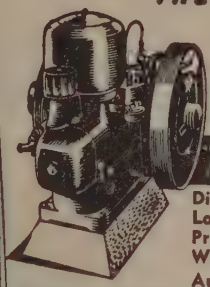

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Geraniums Return to Fashion

Good News for Country Gardeners

By F. BRIDGMAN, B.Sc. (Agric.)

Fig. 1.—Modern geraniums showing large size of flowers

GERANIUMS have returned to fashion—largely because of striking new hybrid varieties that have recently been produced. These modern varieties have much enlarged flowers with individual florets up to two inches across borne in heads over six inches wide, in a glorious range of colours embracing whites, pinks, salmons, orange, reds, purples, and even chocolate shades. In England they have been used as a main feature in Buckingham Palace gardens; Beverley Nichols has written of them, while in America they have become nothing less than another colossal all-American cult.

This revival of interest in an old favourite is good news to country gardeners in Western Australia because geraniums show extreme hardiness in regard to drought—a big factor in their favour in wheatbelt and other areas where the water supply is often difficult to say the least. Geraniums are native of the arid parts of South Africa. Their thickened stems store water and food reserves—so stems can even be cut off from the plant and left hanging in a scorching sun for days and still recover. Generally geraniums are ideally suited to Western Australia's climate—more so than they are to the U.S.A., England or even the Eastern States. In most West Australian districts, protection from frosts in the winter does not seem to be necessary—only in a few cold inland districts does it even need considering.

Moreover, the attention needed for geraniums is only moderate in its demands on time—a further virtue worth considering by those who might be too busy for much other flower gardening. They are thus very suitable for a farm garden. Diseases are rare in this climate. This is not to say that geraniums can be completely neglected—plants so neglected in poor corners soon become unsightly and have contributed to the undeserved poor reputation of geraniums in the past. On the other hand, geraniums respond excel-

lently to necessary care by way of pruning, fertiliser and general attention, showing vastly improved colour and flower size as a result.

A QUESTION OF NAME

The answer to the old question as to when a geranium is not a geranium is that strictly speaking, all commonly-called geraniums are really zonal pelargoniums and those called pelargoniums are more adequately described as regal pelargoniums. There is also a botanical genus, commonly called not geranium but cranesbill—quite a pretty plant with dainty flowers like butterflies in pink, red, white and especially blue shades, suited to rockeries and an excellent fancier's plant, but it is as much different from garden geraniums or pelargoniums as peas are from beans.

The names, geranium and pelargonium, are derived from the Greek (*Geranos*—a crane and *Pelargos*—a stork) and allude to the striking resemblance of the seed-vessels to the long, tapering beaks of these birds.

The garden geraniums are actually zonal pelargoniums so-called because of the dark horseshoe markings around the leaf. They arose from a cross between the two wild species *Pelargonium zonale* and *Pelargonium inquinians,* and botanically this group is called *Pelargonium hortorum.*

Those plants commonly known as pelargoniums are better called regal pelargoniums (*Pelargonium domesticum*)—a hybrid between several wild pelargonium species. They can be distinguished from garden geraniums (zonal pelargoniums) because of their crinkly deeply-indented leaves, and their vividly-blotched flowers.

A fourth group are those commonly called "ivy geraniums" or "climbing pelargoniums," (botanically *Pelargonium peltatum*). There are also other various pelargonium species worth considering by the keen fancier such as the oak-leaved pelargonium (*Pelargonium quercifolium),* the rose pelargonium (*Pelargonium graveolens*) and other species including hybrids.

But the confusion in the common names of our plants does not complicate their culture. The cultivation of all the main pelargonium groups namely the garden geraniums (zonal pelargoniums), the regal pelargoniums and ivy geraniums or climbing pelargoniums does not differ very much. The regal pelargonium seems to have a wider range of more sophisticated colours particularly in the mauve, purple and chocolate range. Regals also have a shorter but more concentrated flowering season than the zonals, which, on the other hand have a longer flowering period. Individual flowers of the regals are larger, but the flower stem is shorter than in the zonals. It seems slightly harder to strike cuttings of regals than zonals, but both are far from difficult in this regard. In my opinion, the regal pelargonium is often better for garden display than the zonal pelargonium or geranium.

The term "geraniums" as used hereunder refers to all three main varieties unless otherwise mentioned.

PLACE IN GARDEN PLANNING

Geraniums can form the main backbone of a garden; between the tall trees and shrubs in the background and the small annuals in the foreground. They can, with their bright free-flowering habits, fill the dominant position in the garden. Geraniums can be used as a complement to and even as a substitute for, roses. Indeed the whole garden can be based on the various geranium and pelargonium species, plus trees of course, giving simplicity in garden design and economy in garden time. Geraniums are pre-eminent for window boxes, in pots, in rockeries or built up beds. The double ivy geraniums can be used in bedding as well as being put to all the normal climbing purposes—on trellis, on pergolas, as trailing plants from window boxes, and as cascades over rockeries. The garden geranium and possibly the regal pelargonium can be trained as standards like the standard roses—that is by nipping off side shoots until the desired shape is obtained.

When geranium roots are confined in a relatively limited space as in pots and other containers, their free flowering habit is encouraged and accentuated.

Regal pelargoniums allowed to grow to a large size can be used as specimen plants or even as the shrub background to the garden.

Fig. 2.—Geraniums have been used for some years in the most important garden situation in London—the Victoria Memorial beds in front of Buckingham Palace

Garden zonal geraniums cut well back can be used as low hedges or edgings to paths; zonals allowed more freedom and regal pelargoniums can be used as hedges.

Coloured leaf varieties of garden zonal geraniums can be grown as contrasts or reliefs to the masses of flowers produced by the large flowering kinds; or they too can be used for bedding.

PROPAGATION

There is no need for any special fuss or bother in propagating geraniums by cuttings in our ideal weather conditions. Cuttings can be either struck in an open bed or, for special purposes in pots at almost any time of the year. If struck in pots it is possible to use coarse sand which is an advantage for faster rooting—but if your ordinary soil is sandy this makes little difference. Pots do tend to dry out very quickly during our hot summers and if used during this season should be kept in a shady place until the cutting strikes.

The cuttings can be taken in two ways. About 6in. to 9in. lengths of the ripened hardened green wood stem can be cut and then left out of the ground for a few days before planting, after which, they are thrust into the soil. A second method is to take about 4in. to 6in. of soft, growing stem and put it immediately into the bed or pot before drooping takes place. Personally, I have found the first method more convenient and more successful.

Cuts in all cases should preferably be done just below the node or stem joint, or a small heel of stem left. Rooting hormone powder can be tried to hasten rooting but this is a matter of convenience, and is not essential.

Geraniums may be raised from seed—indeed this is the way new varieties are obtained—but to get seedlings with flowers worth having, care is needed in the source of seed used. Preferably, seed you have saved yourself from your best plants

should be used or alternatively, good seed should be purchased from reputable nurserymen if possible.

PRUNING

Much of the poor reputation of geraniums in the past was due to the lack of trimming given the plants, which were allowed to become straggly and lanky with little fresh growth, eventually ending as unthrifty and unproductive. Pruning of geraniums will well repay the small effort involved and is simple—there are no inner mysteries nor "dark of the moon" practices involved. The main aims in trimming or pruning geraniums are:—

(1) Keeping the plant compact and shapely, according to its place or purpose in the garden.

(2) Producing plenty of fresh growth and leaves.

(3) Simultaneously maintaining its free-flowering habit.

Any method which fulfils these aims is satisfactory. Only a few suggestions are given here. An old plant that has become overgrown, lanky and unsightly should have the dead wood and all stems except three or four cut out. The stems left should then be cut off about 4in. to 5in. above the ground in the case of the garden geranium or zonal pelargonium and a little longer in the case of regal pelargoniums. Ivy geraniums only need thinning of the dead stems, some being cut out or cut back if necessary, plus an outside trimming. This should be preferably done in autumn or winter time, thus encouraging spring and summer flowers. During the summer, some vegetative buds and young shoots can be pinched out to make compact growth. Such summer treatment encourages winter flowering.

In subsequent years a repeat trimming can be carried out according to the shape desired, generally being less drastic than the first pruning.

With young plants recently established from cuttings, growth can be permitted to go its own way for a while and then the leading shoots cut back to encourage branching. Unwanted stems should be thinned out.

DIGGING

Apart from the digging at the preparation of the bed, plants should be lightly forked around after pruning. Weeding should be done when necessary but generally less work is needed in this respect than with other plants.

FERTILISING

Geraniums can give a marvellous response from correct fertilisation. There are two aspects to watch; giving the plant sufficient nitrogen, phosphate and potash for healthy vigorous growth and long stems, but not over-fertilising with nitrogen so that freedom of flowering is reduced. Geraniums need some nitrogen but not too much. If growth is lacking in abundance with a pale leaf colour, more nitrogen should be used; if excess leaf growth with few flowers occurs, nitrogen should be discontinued while extra potash should be added.

Ready-made garden fertilisers mostly seem too high in nitrogen for geraniums. One suitable available fertiliser appears to be Potato Manure A, which contains phosphates, potash and a small quantity of nitrogen. Another suitable mixture that can be made up at home is three parts of blood and bone, to two parts of super and one part of potash. Either of these mixtures can be applied at the rate of about one ounce of mixture per square yard twice yearly (including preparation of the bed.)

Little is known of the reaction of geraniums to trace element deficiencies. Possibly they occur, but geraniums are generally very hardy plants. If a known deficiency exists in your soil the specific trace elements lacking—and only these—should be used. If you suspect a trace element deficiency, or other trouble, it would be as well for you to consult the Department of Agriculture.

Well-rotted cow manure, horse manure or compost, but not fowl manure, can be used sparingly on geraniums, one application at the preparation of the bed being normally sufficient.

Geraniums struck in sand in pots should have their soil changed when the plants become established. A suitable mixture that partially retains water is required.

A suggestion is sandy loam or light loam, or even fertile sand, preferably the former, mixed with a small amount of compost. A similar mixture can be tried in window-boxes, pots and other containers. Artificial fertiliser can be used as described above, but there should be no need for further animal manure. A few crocks or small stones should be put in the bottom of the pot or container and drainage holes provided where necessary—as for other pot plants.

Fig. 3.—Variegated-leafed varieties of geraniums make attractive pot plants

WATERING

It is essential to keep cuttings watered adequately until they have formed roots.

Established plants in the open ground are very drought-resistant and will survive long periods without watering. However, in dry times as much water as it is possible to spare from any source will be helpful. Where water supplies are good, geraniums can be watered about once a week. In pots and containers, watering may need to be more frequent.

PESTS AND DISEASES

In this climate geraniums are remarkably free from diseases. The only complaint of any importance is rust and even this is usually limited in its damage. It occurs as black spots on the leaves which spoil the appearance of the plant. Where this is noticed, some control may be obtained by dusting with sulphur or spraying the flowers with colloidal sulphur.

Insect or snail damage to the leaves is not usually serious but should they become wide-spread, the pest concerned should be indentified and the appropriate treatment given accordingly.

VARIETIES

The modern varieties from England and America have been slow coming on the market here, because the arrival of stock has been rightly regulated by quarantine. Some local nurserymen, I understand, will be getting a few new varieties shortly. Eastern States nurserymen have also supply difficulties and, in some cases, waiting lists. But some regal pelargonium varieties can be obtained in the Eastern States at the present time. Eventually plants will be multiplied and soon be readily available throughout Australia. In the meanwhile, many older varieties are worth collecting—though many are poor, some are rich in flower, colour, shape and even size. The following is an incomplete list of varieties both old and new—the very modern ones are not included because of their unavailability.

Garden Geraniums or Zonal Pelargoniums.

Strong-growing varieties with large flowers, each individual floret about 1½in. in diameter.

Gaiety—pink.
George Lansbury—red.
Josephine Osborne—purple.
King Victor Emmanuel—red.
Maxine Kovaliski—orange.
Pink Drummond—pink.

Pelargoniums or Regal Pelargoniums.

Large flowers, each individual floret about 1½in. in diameter with the trussess of flowers up to 6in. across.

Captivation—white overlaid carmine, frilled.

Evelyn—white with dark blotch, shading to carmine.

Goldmine—rich rose pink with white centre.

Henry Perkins—deep carmine, very large head.

Her Majesty—white.

Lilac Emblem—lilac.

Market Favourite—deep pink with white edge, wavy edges, large flowers.

Mabel—dark chocolate shade.

Purple Beauty—purple, dwarf habit.

Rustic Beauty—burgundy red, dwarf habit.

There is also an old variety around Perth the name of which I do not know, but it is exceptionally large-flowered (individual florets 2½in) and free-flowering, being almost covered with bloom of a rose-pink colour.

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LUCERNE AND BANANA TRASH FOR SHEEP FEEDING

An interesting experiment at Carnarvon

By H. SUIJDENDORP

ALTHOUGH Carnarvon is the port for a large area of pastoral country, local butchers often find it difficult to obtain fat stock for slaughter and it is occasionally necessary to have mutton carcasses shipped from Perth to supply the local trade.

Recently, the Gascoyne Research Station conducted a sheep-feeding experiment, using locally-produced lucerne hay and banana trash for fattening store sheep.

On October 28, 1955, a line of 20 store wethers was purchased from Bidgemia Station. The sheep were all full-mouthed or older and were bought for 30s. each. The average liveweight on purchase was 105.5 lb. but they were very mixed in quality with actual liveweights varying from 95 to 131 lb.

At slaughter on January 25, 1956, the average liveweight was 114.8 lb., with an average dressed weight of 49 lb. The wethers killed out well with a good covering of fat and very tender meat and sold at 55s. each.

DETAILS OF FEEDING

Immediately after purchase, the sheep were given as much lucerne hay as they would consume, in a paddock containing some acacia scrub. After two weeks during which they consumed 3.2 lb. of lucerne hay per head daily, their average liveweight increased to 112.5 lb.

It was noted however that when the acacia scrub was eaten out at the end of two weeks, the appetites of the sheep appeared to diminish and they only ate 2.6 lb. per head per day of the lucerne hay. A decline in liveweight occurred during the next two weeks.

The wethers were then transferred to an abandoned banana patch, banana plants being cut down as required. They received no lucerne hay or other supplementary feed but showed slight weight gains in the first four weeks.

The banana trash was then supplemented by ½ lb. of lucerne hay per head daily and good weight gains occurred immediately. After a fortnight on this ration, the liveweight levelled off at approximately 115 lb. average and was maintained until the animals were slaughtered on January 25, 1956.

CONCLUSIONS

Although the experiment was merely instigated as a preliminary fact-finding measure, it appears that the best results are obtained when some bulk feed is available in addition to lucerne hay.

It appears that store wethers fed on ½ lb. per head, per day, of lucerne hay with free access to banana trash or an abandoned banana block would fatten sufficiently within four weeks to be ready for sale to a butcher. An acre of abandoned bananas would thus return about £40 by the time it was grazed down.

To feed lucerne hay alone would be uneconomic as the return from an acre of lucerne would be no greater than if the lucerne was sold as hay.

Varying demands for fat stock and variations in the availability of stores, suggest that the breeding and rearing of fat lambs may be a sounder proposition.

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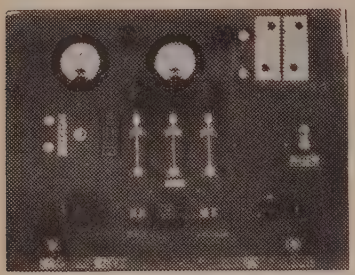

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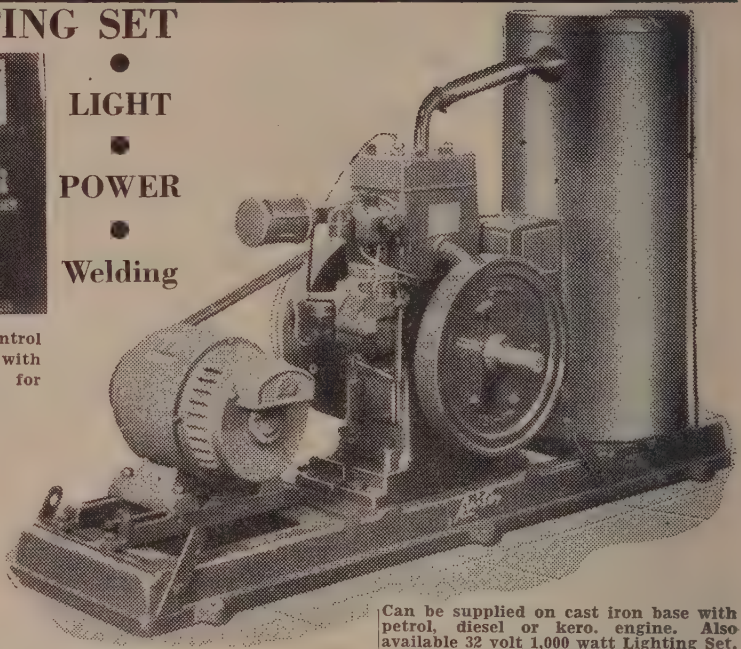

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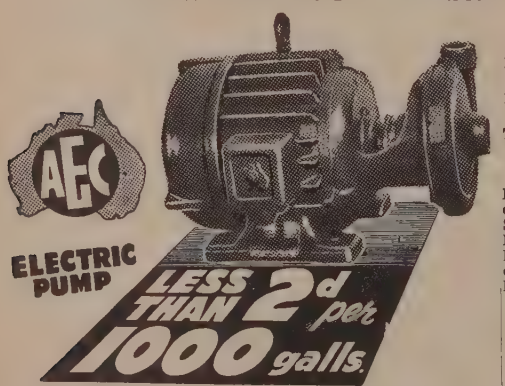

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Fig. 1.—The staff of the Agricultural and Pastoral Section of the Government Statistician's office, preparing forms for despatch to farmers and pastoralists.

RURAL STATISTICS

Why They Are Needed

By A. McKINNON, Government Statistician's Office

TOWARDS the end of March or early in April you should have received an envelope containing two copies of a Statistical Form A.P. 19, one of which you were requested to complete and forward to the Government Statistician with particulars of your farm, orchard or station. I wonder whether your first thoughts on opening the envelope were "What's the use of all these details" or "Why can't they make the period coincide with my tax return" or perhaps "Well, I had better fill it in to avoid getting into trouble." I hope you did not adopt that negative attitude because this inquiry can have important bearing on you as an individual and on the well-being of the rural industry which plays such an important part in the Australian economy.

I would like to tell you something of the reasons behind the collection of this information and the uses to which it is put. I will also try to dispel any doubts that may have arisen in your mind as to the confidential nature of your individual particulars and explain why the collection is made at March 31, instead of June 30.

PRINCIPAL USES OF FARM AND PASTORAL STATISTICS

Although secondary industry has progressed rapidly in the post-war years and important establishments such as the Kwinana Oil Refinery have been constructed and commenced operations, there is no doubt that the prosperity of this

State still depends largely on the volume of wool, wheat, meat and other primary products which you farmers and pastoralists can grow for sale overseas and the prices realised for your commodities.

Decisions on policy affecting your industry and possibly your own income can only be made confidently and intelligently if reliable and up-to-date statistics are available.

FINANCIAL POLICY

Statistics of farm production are used in compiling estimates of national income and of revenue and expenditure for use in the preparation of the Federal Budget. It is not possible for the Federal Government to determine what revenue it can expect to collect during the coming year from income tax, customs duties, sales tax, etc., without forecasts of what the people's income is likely to be. In arriving at these estimates it is essential that we have reliable and up-to-date records of primary production with which to work.

For instance, the volume and price of wool, wheat, meat and other primary products which will be sold on world markets directly influence, not only your income, but also that of the very large section of the community which provides services for you. In fact, any sharp downward movement in farmers' income from these sources would be reflected in Federal revenue and, as far as possible, the Government must be in a position to forecast changes in revenue collections when budgeting for the coming year.

An assessment must of course be made of commitments in regard to subsidies and guaranteed prices for primary products, and this can only be made on the basis of statistics of production and disposal of the commodities affected.

Since the introduction of uniform taxation, which is collectable by the Federal Government, all Australian States are dependent on Commonwealth reimbursements in lieu of income tax. This has not meant, however, that the State Government could afford to plan its expenditure without consideration of seasonal conditions and the progress of both primary and secondary industry. Firstly, it is well aware that prosperity or depression in this and other States has a direct bearing on Federal revenue and eventually on reimbursements to the States. Secondly, in budgeting for the coming year the State must estimate earnings and expenditure for its many public utilities such as the W.A.G.R., State Shipping Service, etc. The finances of these concerns are, of course, influenced considerably by seasonal conditions in country areas and a bad season for farmers and pastoralists can mean a sharp fall in earnings. The State Government therefore in preparing its budget and formulating financial policy for the year has regard for statistics on rural production.

In the case of the claimant States (South Australia, Western Australia and Tasmania) additional special grants are made by the Commonwealth Government under Section 96 of the Commonwealth Constitution. These grants are assessed each year by the Grants Commission and in preparing Western Australia's case for assistance our representatives deal not only with the State's disabilities (huge area, sparse population, etc.,) but they also take into consideration seasonal conditions, crop prospects and the general progress of primary and secondary industries. In this work current statistics on all phases of the State's economy are essential to provide the members of the Commission with a true picture of agricultural and industrial development.

OVERSEAS TRADE AND BALANCE OF PAYMENTS

The recent alterations to the structure of the Federal Cabinet highlight the importance which the Government places on oversea trade and its effect on the country's balance of payments and subsequent repercussions to our internal economy. In the recent moves the administration of the Department of Trade was separated from Customs and placed under a senior Minister who will be responsible for the task of maintaining or expanding overseas earnings. Any improvement in our external funds could, of course, be taken into account in determining Government policy on import restrictions which were imposed in 1952 to arrest the serious deterioration in Australia's overseas finances.

Federal officials who are responsible for policy in regard to trade development require up-to-date statistics of primary production and reliable forecasts for the coming season to assist them in planning on sound lines.

NATIONAL PLANNING AND DEVELOPMENT

Loans from Government sources or from financial institutions for expenditure on new public works do not receive Loan Council approval without careful consideration of all facts which could help to arrive at a decision on the soundness of the project under consideration. In Western Australia projects for the development of land settlement, irrigation, water supply, power, etc., are planned and carried out by the State Government. In most instances, however, the State is dependent on the Commonwealth for financial assistance for these projects and in preparing a case for submission to the Federal Government it must have statistics of the activities of the area to be covered by the scheme under consideration in order to arrive at estimates of the possible increase in productivity.

As an instance of this, the committee which planned the Comprehensive Water Supply Scheme and prepared the case for Commonwealth assistance made extensive use of farm statistics relating to the area which the scheme will finally cover. In February last the pipeline which now brings water to Narrogin from the Wellington Dam, 80 miles away, was opened by the Minister for Works and Water Supply. This pipeline is the first link in the Scheme which will eventually alleviate the water problem of a number of country towns.

AGRICULTURAL RESEARCH AND ADVISORY POLICY

The valuable work of the Commonwealth Scientific and Industrial Research Organisation on the technical problems of your industry is well known to you. Farm statistics have been most helpful in assessing the results and value of some of the discoveries of this Organisation. The Commonwealth Bureau of Agricultural Economics which confines its research

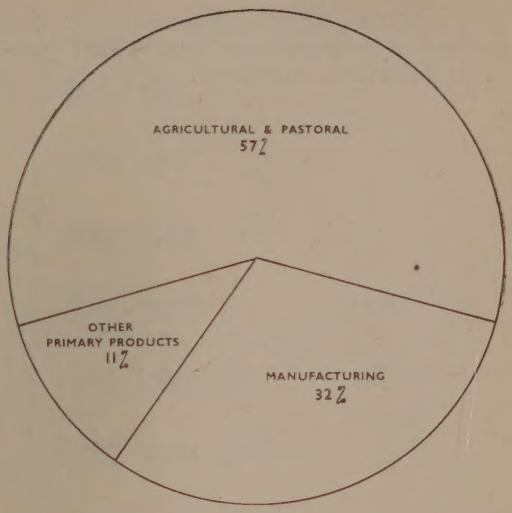

Fig. 2.—The importance of primary production in Western Australia's economy is shown by this diagram. Of the State's net value of production, 57 per cent. comes from Agriculture and pastoral products and 11 per cent. from other primary industries such as mining, fishing and forestry.

mainly to the finances of your industry uses agricultural statistics extensively in its investigations and is most anxious to have up-to-date information.

You are no doubt aware of the extensive research conducted by the Agricultural Department into the many problems of your industry, the nature of advice tended and help available to you. However, their work is made much more valuable when they know, by reviewing practical results obtained, how their advice has been followed. For instance, they have done very valuable work on the development of new cereal varieties suited to this State's climatic conditions and soils, and statistics of cereal varieties actually sown have assisted them to measure the extent to which their advice in this field has been accepted by farmers.

In recent years the Department of Agriculture has advocated the establishment of sub-clover in the wheat belt and as a result the total area of established pasture in the State has grown from about 2,000,000 acres at the end of the war to 4,750,000 acres in 1954-55. On your "Cereal Varieties" form for 1955-56 you are asked to answer two simple questions which we hope will provide the Department of Agriculture with valuable information on the

area actually under sub-clover and the extent of cropping on land which previously carried sub-clover.

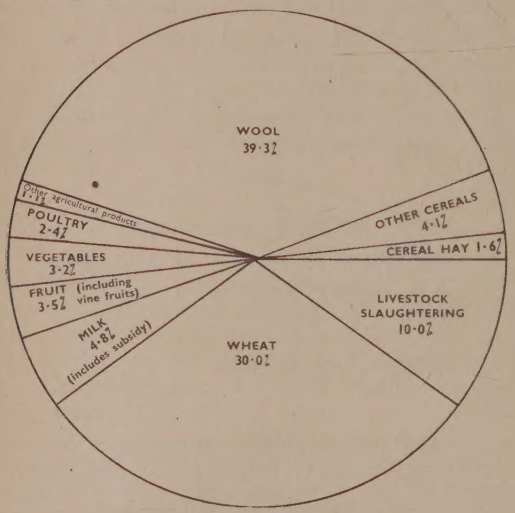

Fig. 3.—A diagram showing the relative gross values of the chief agricultural and pastoral products. (Average 1949-50 to 1953-54 seasons.)

DIVISIONAL ACTIVITIES OF DEPARTMENT OF AGRICULTURE

Dealing with Divisional activities of the Department of Agriculture, I have a strong feeling that the Departmental Officers, who are fairly constantly in touch with you, would be better able to tell how they use the wide range of statistics supplied to them by this office. I do know that the results of the annual collection of agricultural and pastoral statistics are impatiently awaited by Officers of that Department who are keen to know whether their particular section of the industry has progressed. I am sure the information we are able to give them from your returns helps them to review their past work and plan their programme for the current year.

SOIL CONSERVATION

In a previous issue of the Journal of Agricultural, Mr. G. H. Burvill, Commissioner of Soil Conservation, summarised results of the 1955 Salt Land Survey which was based on five questions asked on the "Cereal Varieties" Form. The response from farmers was very satisfactory. Returns were summarised in this office and provided valuable information on a problem which has concerned the Department of Agriculture and the Farmers' Union for some years. I have no doubt the information will be of value to the Commissioner in assessing the extent of the problem and formulating Departmental policy with regard thereto.

FARMERS' ORGANISATIONS

Executives of your own organisations find current information on farm and pastoral activities most useful in their work of carrying out policy, in keeping themselves advised on progress of the industry, and even on matters such as wage fixation. For instance, in preparing cases for presentation to the Arbitration Court in connection with the fixing of shearing awards both the Farmers' Union of W.A. and the Pastoralists' Association have used statistics obtained from the Statistical Office. The Salt Land Survey mentioned above, which was actually the result of a motion carried by the Annual General Conference of the Farmers' Union expressing concern at the seriousness of the soil salinity problem, was an example of a special statistical survey being done at the specific request of a farmers' organisation.

MARKETING OF PRODUCTS

Successful planning for marketing rural products is helped considerably by up-to-date statistics for forecasting and estimating production. To assist in meeting this need this office, in collaboration with the Department of Agriculture, prepares two pre-harvest forecasts of wheat production which are based on "areas intended to be sown" given on your annual returns. The current difficulties of disposing of our exportable wheat surplus has created an acute storage problem which will not ease until there is a stronger overseas demand for our wheat. In the circumstances it is most important that reliable crop forecasts be available to those responsible for marketing the harvest.

Although wool is not subject to Government control, advance forecasts of receivals and production are most important to brokers and the Government, and two meetings of interested bodies are held each year in every State to make forecasts

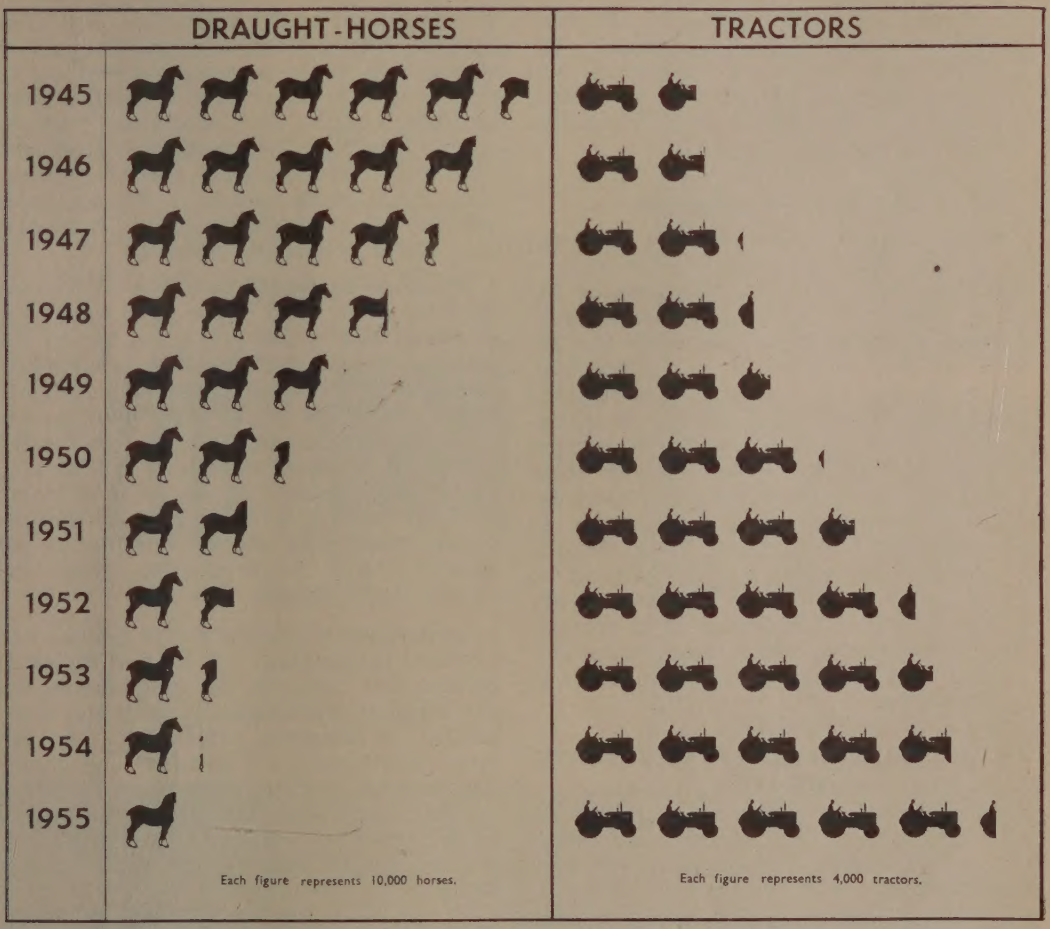

Fig. 4.—This diagram, based on the official statistics, shows the decline of the draught-horse population of the State over the period 1945-55 and the corresponding increase in tractors. From 54,759 draught horses in 1945, the numbers dropped to 8,521 in 1955. There were only 6,624 tractors in 1945; the 1955 figures were 21,166.

for the current selling season. In Western Australia the meetings are attended by representatives from the four wool-selling brokers, Farmers' Union, Pastoralists' Association, Bureau of Agricultural Economics and a Statistical Officer is present to submit current statistics. The results of the State meetings are later reviewed by a Federal conference and final estimates of wool receivals are determined which are used by the National Council of Wool Selling Brokers in organising sales throughout Australia. The forecasts are also most important to the Commonwealth Government in estimating national income for budget purposes.

PRIVATE INDUSTRY

Manufacturers, wholesalers and retailers who are doing business with farmers continually use agricultural statistics to help them in determining production and distribution policy. They are particularly interested in current district statistics which can be used to direct their sales staffs into areas where they are most likely to do business. Machinery manufacturers and distributors, for instance, are constantly seeking from us statistics on the numbers and types of agricultural implements and machinery in Local Government areas. This information, studied

in conjunction with crop and livestock statistics, assists them to estimate the potential market for new machines and replacement parts and provides them with a guide to the proportion of sales handled by their firm.

SECRECY OF RETURNS

Section 18 of the Statistics Act says that no return shall be published in such a manner as to reveal the contents of the return, without the previous consent in writing of the person who made the return. It also provides that returns shall not be sighted by any person not engaged in the collection or compilation of statistics. As an additional safeguard, Section 19 provides that the Statistician or other officer having custody of returns shall not be required by subpoena or otherwise to produce them to any court. These sections of the Act are most strictly adhered to by Statistical Officers, all of whom are obliged to sign an undertaking of secrecy. This means that no other Government Department or authority may have access to your returns.

PERIOD TO WHICH ANNUAL RETURNS RELATE

The period for which rural statistics are collected has been the subject of a number of queries from farmers and farmers' organisations.

Firstly, I want to make it quite clear that agricultural and pastoral statistics are collected at March 31 by all States and that no movement in the date could be made without agreement between States. The matter was last discussed at the 1949 Conference of Statisticians when it was unanimously agreed that a season ended March 31, was most suitable for the varying seasonal conditions of all States. The Statisticians decided that any later date would seriously affect the value of statistics to the many persons and authorities who use them.

In this State all cereal crops have usually been harvested and delivered by the end of March. This date therefore is quite satisfactory for this collection, which is designed to provide information on cropping and livestock as early as possible after the end of the cereal cropping season. The postponement of the collection until after June 30, would mean that information relating to a particular season would not be collected until some time after the commencement of the succeeding season. Apart from the possibility of confusion regarding data required, such an alteration would cause at least a further three months' delay in the release of information which is urgently needed.

With the exception of a few items concerning wages and costs of production, financial figures are not asked for on the return. Again, the financial information required on the form is intended to relate to the activities of the season under review and for that purpose the year ended March 31 is most satisfactory. Similar figures for the year ended June 30 would include wages and costs for three months of the succeeding season, and would not strictly relate to production from the season under review.

Most items on the form are designed to provide information of a non-financial nature and there is no adequate reason for delaying the collection until the completion of financial returns for the tax year. Furthermore, I consider the choice of a between-seasons date, such as March 31, most convenient for the farmer as well as providing this office with early data on this important aspect of the State's economy.

On the whole the present system of postal collection of farm statistics has been well received by the farming community and, in comparison with the old method of police patrol, we feel it has the advantage of allowing you reasonable time in which to study and complete the form.

In a final appeal I would ask you, when filling in your return, to pay strict attention to the accuracy and completeness of the information submitted as this is the only means of obtaining reliable District and State particulars.

In thanking you for past co-operation I would like to add that the Statistical Office welcomes any constructive criticism of the form or the method of collection. Our staff at all times will be pleased to answer your queries and, if necessary, assist you in completing your return.